WBS 3.0, C-0 Outfitting

Portion of the

BTeV Project

This document contains the Advanced Conceptual Design Report, Project Execution Plan for WBS 3.0, and related reference material.

Fermilab

FESS/Engineering Project No. 6-8-3

Rev. 0

C-0 Outfitting
WBS 3.0
BTeV Project

Advanced Conceptual Design Report

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Fermilab

Fermi National Accelerator Laboratory

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FESS/Engineering Project No. 6-8-3

Rev. 0

This Advanced Conceptual Design Report (CDR) is intended to be a self-consistent basis for a project baseline cost estimate. It is not a Title 1 report and has not answered every technical design question. The current level of contingency is believed to be consistent with the degree of technical confidence in the design at this stage. It is recognized that some basic construction concerns will be reviewed and optimized during the remaining stages of the project.

This Advanced Conceptual Design Report is meant to augment the project's Conceptual Design Report by providing more in depth levels of detail.

EXECUTIVE SUMMARY **C-0 Outfitting**

This section of the Advanced Conceptual Design Report (CDR) defines the scope, cost and schedule for WBS 3.0, C-0 Outfitting portion of the BTeV project. The BTeV experiment will reside in the C-0 Building located at the C-0 station of the Tevatron Accelerator. This sub-project provides the required services and spatial configuration required to support the BTeV experiment. In addition this subproject provides for the building modification and electrical upgrades to the B-4, C-0 and C-1 Main Ring Service Buildings that are required to support the Interaction Region (IR) components.

Three main construction work packages are anticipated:

> C-0 Outfitting Phase 1, installs the mezzanine structures, concrete masonry walls, fire protection, fire detection and electrical services needed to construct and test the magnet and torroids in the Assembly area.
>
> C-0 Outfitting Phase 2, installs the heating ventilation air conditioning (HVAC), process piping systems, and power required to support the BTeV detector electronics.
>
> C-0 Sector High Voltage Power upgrade installs the 13.8 kv power required for full operation of the C-0 Building and for the IR at C-0.

PROJECT COSTS

The Total Estimated Cost (TEC) for WBS 3.0, C-0 Outfitting, is estimated to be $7,213,157.

No Escalation, Full material Procurement 'Burdening'

Activity ID	Activity Description	Material & Services Cost	Labor Cost	Base Budget	Labor Contingency ($)	Materials & Services Contingency ($)	Total Budget (Base + Contingency)
CONSTRUCTION							
		$4,896,576	**$1,084,177**	**$5,980,754**	**$216,835**	**$1,015,567**	**$7,213,157**
1 -- C-0 Outfitting Phase 1							
		$1,812,958	$426,288	$2,239,246	$85,257	$362,591	$2,687,095
2 -- C-0 Outfitting Phase 2							
		$1,859,031	$444,071	$2,303,102	$88,814	$408,058	$2,799,975
3 -- C Sector High Voltage Power Upgrade							
		$599,249	$175,470	$774,720	$35,094	$119,849	$929,664
4 -- Pre Procured Items							
		$625,337	$38,347	$663,684	$7,669	$125,067	$796,421

The TEC includes Construction, EDIA (Engineering, Design, Inspection and Administration). Management Reserve and Indirect Costs, although included in the above dollars, will be held in Project Management. The TEC have been estimated in FY05 dollars. No escalation has been included.

Section VI, Cost Estimate Detail, of this document contains breakdown of the TEC for WBS 3.0 C-0 Outfitting. Additional details can be found in the Open Plan file.

SCHEDULE

Section VII, Schedule Details includes a print out of the Open Plan detailed bar chart for WBS 3.0 C-0 Outfitting. Additional schedule information can be found in the Open Plan file. The following is a list of the major milestones included in WBS 3.0.

Activity ID	Activity Description Activity	Finish
3.5.1	Lev2Mil: MS-1 Start Engineering	01Oct04
3.5.2	Lev1Mil: MS-2 Start Construction	28Jan05
3.5.3	Levl3Mil: MS-3 Side Bay. Struct. Complete	26Oct05
3.5.4	Levl3Mil: MS-4 Temp. Power Operational (Fdr 45)	15Nov05
3.5.5	Lev1Mil: MS-5 Beneficial Occupancy of lower level And upper staging area	17Jan06
3.5.6	Lev1Mil: MS-6 Collision Hall Complete	07Sept07
3.5.7	Levl3Mil: MS-7 MECH Systems Complete (Ex.CH)	21Aug07
3.5.8	Levl3Mil: MS-8 Electrical Systems Complete	16Aug07
3.5.9	Lev1MIL: MS-9 Assembly, Service Building Construction Complete	07Sept07
3.5.10	Lev2Mil: MS-10 Engineering Complete	12Nov07

Existing Conditions

C-0 Test Area

In 1998 Fermilab started construction of the C-0 Test Area at the C-0 straight of the Tevatron Accelerator. The layout for the C-0 Collision Hall Area is similar to the D-0 colliding beam facility. The current C-0 Building is a weather tight building shell with overall dimensions of 78' x 60' wide x 26' above grade. An 80' long x 30' wide x 22'-6" high Collision Hall lies on the Tevatron Beam line. An equipment by-pass extends around the Collision Hall at El. 722'-6 to provide continuity of the service aisle that is adjacent to the Tevatron beam line components. The Tevatron Enclosure approaches to the Collision Hall were constructed wider than the standard Main Ring enclosure with a depressed floor at El: 720'-0 to accept the Low Beta components. The Collision Hall, By-Pass and approach enclosures were constructed with the lighting, electrical services, cable trays and process piping to support the Tevatron Beam line components. The Collision Hall also included sprinkler piping to be connected to the ICW system included in the current C-0 Outfitting Phase 1 Work package.
The Collision Hall is connected to the Assembly Area via a movable shield door and personnel labyrinth. The central region under crane coverage is 33' wide x 50' long with alcoves of varying depth along the south and east perimeter. The Assembly Area and adjacent Receiving Area have been constructed with an overhead 30-ton crane, high bay lighting, spot smoke detection and fire suppression piping. A side bay 25' wide x 75' long has been construction with the columns designed to support two additional mezzanine floor decks. Stairs, elevators, electrical and mechanical rooms were considered in the original design.

C-0 Service Building

The C-0 Service Building is located on the inside of the Tevatron berm. A portion of the building is used to house a compressor for the Tevatron cryogenics. The B-4, C-1, and C-0 Service Buildings contained power supplies for the Main Ring. With the construction of the Main Injector these power supplies are no longer required and allow for the space to be reused for supplies that are required for the IR. See the detailed descriptions provided in WBS 2.0 Interaction Region Advanced Conceptual Design.

Proposed Site work

The C-0 Outfitting site work involves upgrades of the existing C-0 Building constructed in 1998 and will install the power and mechanical services required to support the BTeV project. Upgrades to the site area includes the construction of mechanical equipment and Dewar support pads, a shed type building for gas bottles, underground utility work for and a new 13.8 KV feeder duct bank from the existing manhole at the B-4 Service Building to a new transformer pad at the C-0 Building. The transformer pad will contain three new 1500 KVA transformers, 13.8 kv switchgear and a 250 KVA Diesel Generator. Included in the site electrical work will be the construction of a new bus duct enclosure from the C-0 Service Building to the Collision Hall. Also included is the installation of a new 1500 KVA transformer at the C-0 Service building and new 500 KVA transformers at service buildings B-4 and C-1.

Architectural

The architectural build out portion of this project consists primarily of the installation of walls, doors, finishes, stairs, elevator, and raised computer flooring. Once the concrete floors have been installed to provide new floor levels at elevations 755'-4" and 764'-2", concrete block walls will be constructed between the high bay area and each of the newly installed floor sections on the north side of the building. Two of the 3 floors will have windows installed between the newly occupied space and the existing high bay. These windows will allow in daylight from the existing high bay skylights to enter the new areas, thereby enhancing the quality of the spaces, and allowing occupants to view the activities below.

Concrete block walls and hollow metal doors will be installed to enclose the equipment room, the elevator shaft, the stairway, the toilet rooms and janitor closets, as well as the mechanical and equipment rooms at elevations 731'-4" and 715'-0". An elevator will be installed in the existing previously planned shaft space. The elevator will be a 5,000-pound capacity "hospital" type elevator with openings on either end as required to accommodate the floor plan, with a total of 5 stops. Slight modifications will be made to the roof above the elevator shaft, raising it to a height that will provide the required head clearance for the elevator access to the third floor. An enclosed stair will be construction on the north side of the building, to provide the code required second means of egress for the first, second and third floors. It will consist of steel framing with siding and roofing to match the existing building. The current stairways provide the required exits from below grade spaces.

The entrance level (first floor) of the building (elev 746'-6") will have a raised computer floor system installed over the already constructed depressed floor. Also constructed on this floor will be the interior stairs, the stair enclosure and the wall for the electrical equipment room and elevator enclosure, as well as the wall separating this floor from the high bay. Similar to the first floor, the second floor of the building (elev 755'-4") will see the construction of the interior stairs, the stair enclosure walls, and the wall closing off this floor from the high bay. In addition, this floor will house the new single user men's and women's toilet rooms, the janitor closet and a small kitchenette to service the building occupants. The third floor (elev 766'-0") will have a raised computer floor system installed over the newly installed concrete floor construction. Constructed on this floor will be the interior stairs, the stair enclosure wall, the elevator enclosure walls, and the wall separating this floor from the high bay.

Finishes

The wall finishes will consist of painted concrete block for the new block walls. The ceiling finish will consist of the exposed underside of the concrete deck, painted with a textured, acoustical material to improve the acoustical qualities of the room. The interior liner panel of the exterior siding will provide wall finishes along the exterior walls. The second floor will have carpeting. The first and third floor computer rooms will have stringer type computer flooring. The computer floors will be isolated to building ground and have a separate under floor ground grid tied to the primary transformer grounding loop. The toilet rooms, janitor closet and kitchenette will have ceramic tile floors. All other areas (corridors, stairs, mechanical and equipment rooms) will have sealed exposed concrete floors.

Structural

The new floor levels at elevations 755'-4" and 764'-2" will be eight-inch thick post tensioned, prestressed concrete floor slabs that have been selected to provide a minimum floor thickness. The slab will simple span between steel beams framed into the existing steel columns. Final design will evaluate cost and construction benefits of the precast slab system vs. a cast-in-place post tension flat plate floor system.

Conventional Mechanical (HVAC)

The 3rd floor will be outfitted with 4 (CRAC) Computer Room Air Handlers to handle approximately 342 KW to 350 KW heat load from high density computer racks, or

44 computer racks with heat density of approximately 7.8 to 7.9 KW per rack. Each CRAC will be discharging approximately 52 to 56 F supply air into a common under floor supply plenum. There will be no spare or backup CRAC unit. Each unit will have leak detection sensor. All unit and leak sensors will tie in to a central monitoring panel. The CRAC humidifier system will be plumbed to domestic water to maintain the 45% +- 5 RH at all times. Each CRAC will have corresponding outdoor air-cooled condenser with R22 refrigerant. The raised floor air distribution system plenum height is tentatively set at 1'-10", and may be optimized during design stage. The layout of the racks will utilize the "hot-aisle cold-aisle" concept commonly used in present day high-density data center. Due to lack of ceiling height, there will be no common return plenum. The rack dimension given is based on Wide Band HDCF Project at 3 ft x 2 ft x 6.5 ft height. The placement of this equipment in relation to the CRAC is very critical in ensuring optimum air distribution therefore the floor layout may be altered during design stage. The space condition is at 72 F dry bulb and 45%RH, and designed with no occupant heat load during standard operation. The space to be occupied by the under floor cabling is not yet defined but based on preliminary information it is noted that it will occupy minimal space and is assumed to be no more than 20% of the under floor space. The air supply floor grille will be selected to have higher throw, more free area and less pressure drop to optimize the air distribution.

The 2nd floor office area will be served by a dedicated air-handling unit (AHU) with chilled water coil and electric heating coil. The unit will be located in the mechanical room. Air from AHU (estimated at 5 ton) will be distributed to this area via an insulated ductwork system to be routed to the office area through the pipe/duct chase. This unit will utilize an economizer cycle to cool the space when outdoor air temperatures are appropriate. Minimum outdoor air for 25 persons will be included in the air handling unit design. The space condition is for a typical office space (75 F & 50%RH for cooling, and 68F for heating).

The 1st floor computer area (~132KW or 38 Ton) will be served by a closed loop 55F "electronic cooling water system" (ECW). Except for the ECW header inside the room and the chilled water service to the heat exchanger, the rest of the ECW system, which includes plate heat exchanger, pumps, strainer, UV system, and controls is currently not part of this WBS 3.0, C-0 Outfitting scope. System piping shall be insulated copper. A supplemental computer air handler with no backup, will serve this floor.

The Collision Hall will be served by a dedicated air-handler (estimated at 20 Ton or 8,000 cfm). This air-handler includes chilled water coil, heating coil, and humidifier system to meet the space requirements. There will be two modes of operation, HVAC-normal mode and ODH-purge mode. The cfm requirement for ODH-purge mode is 5,000 cfm. There will be a combination purge fan / return fan that will handle air from the collision hall. The heater coil will be sized to keep supply air above freezing to preclude bursting of the inside piping during ODH mode condition during winter. Redundant HVAC and fan are NOT required, however fans and heaters, required for ODH purge operation will be connected to the generator. The collision hall requires space temperature of 60F to 80F at 40%RH to 50% relative humidity, except during purge mode. The unit will maintain air dew point to 53F, except during purge mode. The Collision Hall space requires a continuous constant make up air for inert gas purges, of no less than 50 cfm. Make up air requirement based on ASHRAE will also be included. This will be served by a dedicated outdoor make up air. The ODH airflow requirement is 5000 cfm.

The Assembly Hall will be served by a dedicated air handler (estimated at 20-Ton/8,000 cfm) with chilled water coil, and heating coil system to meet the space requirements. There will be two modes of operation, HVAC-normal mode and ODH-purge mode. Where applicable, the unit will utilize an economizer cycle to provide free cooling when outdoor air temperature is appropriate. There will be a combination purge fan / return fan that will handle air from the assembly hall. The heater coil will be sized to keep supply air above freezing to preclude bursting the inside piping during ODH mode condition during winter. Redundant HVAC and fan, and backup power to this unit are NOT required. The Collision Hall requires space temperature of 60F to 80F at 40%RH to 50% relative humidity, except during purge mode. The Assembly Hall space requires a continuous constant make up air for inert gas purges, of no less than 50 cfm. Make up air requirement based on ASHRAE will also be included. This will be served by a dedicated outdoor make up air unit. The ODH airflow requirement is 5000 cfm.

The electronic bridge area will be served with two DX split AC unit. Estimated load given from racks is 2 KW.

There will be one outdoor air-cooled water chiller (no backup), preliminary estimate at 120 ton each, which will provide 45 F glycol-chilled water to the air handlers, make-up air unit and the heat exchanger.

The air handlers, make up air unit, chiller and pump in the mechanical room will be outfitted and will be integrated with site DDC controls building automation system. The building HVAC system will be provided with basic controls and monitoring using DDC (Direct Digital Control) compatible with site wide BAS. The chiller and chilled water loop will be provided with taps and minimum flow, temperature and flow sensors for monitoring purposes and alarm and for future connection to

experiments slow process controls. The chiller and pumps are self-controlled and will be started and switched manually. The chiller will have multiple compressors and built-in staging controls. Chilled water pump shall be manually started and switched. The 3rd floor High-density computer rack cooling system will be monitored only using Metasys DDC. The Assembly Hall and Collision Hall air system, and ODH purge system will be provided with basic HVAC control compatible with site wide BAS. Additional sensors and industrial type controls that may be required specific to the experiments will be design and selected by the experimenter/user and commissioning will be coordinated as required. Other sensors and controls as mandated by ASHRAE 90, where applicable to the building system, will be provided. Electrical Room and elevator shaft will not require any HVAC. Applicable requirement from ASHRAE 90.1 (such as economizer, C02 sensors, ventilation controls) will be incorporated.
Heating. Air handler will be provided with electric heating coil. The high bay will make use of the existing electric space heater.

Building plumbing.

Condensate drains will be provided for the 1st floor and 3rd floor-cooling unit. The mechanical floor will be reworked to include floor drains. Building plumbing will be sized and designed in accordance with Illinois Plumbing Code.

Fire Protection / Fire Detection

The fire protection systems will comply with the criteria set forth in the National Fire Protection Association pamphlets and National Building Code. In particular, the pamphlets referenced are as follows:

NFPA 10 – Standard for Portable Fire Extinguishers
NFPA 13 – Standard for the Installation of Sprinkler Systems
NFPA 15 – Standard for Water Spray Fixed Systems for Fire Protection
NFPA 70 – National Electrical Code
NFPA 72 – National Fire Alarm Code
NFPA 90A - Standard for the Installation of Air-Conditioning & Ventilating
NFPA 2001 - Standard on Clean Agent Fire Extinguishing Systems

Currently the existing C-0 Collision Hall has a complete addressable fire alarm system monitoring the entire facility and can be extended to monitor the new fire alarm points. In addition, an existing FIRUS system is installed which signals any fire alarm to our on-site Communications Center, so that emergency personnel can be dispatched.

A description of the fire protection system is as follows:

Collision Hall

Provide a pre-action fire sprinkler system connected to the existing piping network. This system will be designed to provide a minimum of 0.20 gpm per square foot over the most remote 1,950 square feet of sprinkler operation. The pre-action valve will introduce water into the piping network upon loss of air and smoke from an air sampling smoke detection system.
Assembly Hall
Connect with a new sprinkler riser to the existing overhead wet-type fire sprinkler system. This system is designed to provide a minimum of 0.20 gpm per square foot over the most remote 1,500 square feet of sprinkler operation.

Mechanical Rooms

Provide a new wet-type fire sprinkler system utilizing quick response sprinklers, designed to a minimum of 0.15 gpm per square foot over the most remote 950 square feet of sprinkler operation.

Computer/Mezzanine Levels

Provide a new wet-type fire sprinkler system utilizing quick response sprinklers, designed to a minimum of 0.15 gpm square foot over the most remote 950 square feet of sprinkler operation. In addition, a clean agent fire extinguishing system activated by high velocity smoke detection, will be provided to protect the raised computer floors and monitored by an auxiliary releasing fire alarm control panel.

Gas Shed

Provide (IF NECESSARY) a fixed water spray system protecting the gaseous tanks. Requirements will be required during final design.

Electrical

The primary power transformers will be fed from a new 13.8kv feeder routed through spare ducts in the Main Ring duct bank to a breaker at the Kautz Road Substation (KRS). Prior to the installation of this new feeder, feeder 45 will be routed through a new switch at B-4 from an open bay at the B-4 Service Building air switch to the primary transformers. Feeder 45 will allow approximately 2 megawatts of available power prior to the installation of the new dedicated feeder for equipment power testing and building house power. The feeder will terminate at an air switch located on the primary transformer pad. The final configuration will remove the tie to feeder 45 and install a tie to feeder 49 for backup power. A Kirk key system will be provided. The final installation at C-0 includes one 1500 KVA transformer dedicated to the detector's magnet and other equipment operated by power supplies, one 1500 KVA transformer to supply quiet power for electronics and computers, and one 1500KVA transformer to supply house power. Critical safety systems will be on a 250 KVA generator with automatic transfer switch. User power will terminate at disconnect switches or circuited panel boards in computer rooms. Because of the structural systems planned and the existing constraints, all conduits will be surface mounted.

C-0 Service Building Upgrade

The C-0 Service Building Upgrade provides for the architectural and HVAC modifications and electrical power additions to support the Low Beta System at C-0. The existing service building consists of office space, shops and data rooms. The current office/tech space will accommodate new power supplies for the Low Beta System. HVAC modifications include the addition of exhaust fans and exterior wall louvers to cool the power supply room.
A new 1500KVA transformer will be installed outside the C-0 Service Building to support the Low Beta System. The transformer will be connected to the power supplies by underground duct bank through the exterior wall of the service building. The transformer shall be fed from the existing pulse power feeder 23 located in the Main Ring Road duct bank. A new 2000Amp switchboard will be installed. Also fed from feeder 23 are new 500 KVA transformers at Service Buildings B-4 and C-1 that will feed 1200 AMP switchboards. Air switches will be installed to transition from 750 MCM to 350 MCM cable. Other than the power upgrades at B-4 and C-1, no other work in the buildings is anticipated as part of WBS 3.0.

Structural Systems

Design Loads shall be as listed below and in accordance with the Fermilab Engineering Standards Manual:

- Roofs
  - Live load / snow load = 25 psf
  - Snow drift: 25 – 55 psf
  - width = 6.5 ft.
- Stairs and Landings:
  - Dead load =75 psf
  - Live load =100 psf
  - or concentrated load of 300 pounds at center of tread.

- Floors shall be designed to support a concentrated load of 2000 lbs. applied to an area 2'-6" x 2'-6" and a uniform live load of 75 pounds per square foot (PSF) for computer floors and 50 PSF for office floors.

Live Load Reduction:

- Live load reductions are permitted in accordance with code for second floor.
- No live load reductions are permitted for roof or mechanical equipment areas.

Handrails and Guardrails:

- Top rail = 50 plf or 200 lb. concentrated load
  (Applied any direction – not simultaneous)
- infill area = 50 lbs. on an area 1'-0" x 1'-0"
  (The above loads are not superimposed)

Mechanical Systems

The HVAC systems will conform to ASHRAE 90.1, ASHRAE 62 and applicable NFPA requirements and applicable sections of the Fermilab Engineering Standards Manual

Mechanical systems and controls will be further investigated during subsequent phases in accordance with ASHRAE 90.1 and Federal Life Cycle costing analysis.

Heating, Ventilation and Air Conditioning Design Parameters:

- Temperature: 65 degrees Fahrenheit to 75 degrees Fahrenheit
- Humidity: 45% -50% Relative Humidity

Electrical Systems

Electrical system modifications will comply with applicable sections of National Electric Code and applicable sections of the Fermilab Engineering Standards Manual.

Primary Supply 480/277 V, 3 phase, 4 wire
Secondary Supply Power Distribution: 120/208 V, 3 phase, 4 wire
Lighting: 277 V

Illumination Levels:

Main Corridor and Public Areas:	20	fc.
Computer Rooms	50	fc.
Interior Emergency Lighting	5	fc.

Fire Protection Systems

Fire Alarm/Fire Suppression systems shall be designed in accordance with the applicable sections of the Fermilab Engineering Standards Manual.

Automatic sprinkler systems shall be designed to a minimum of an Ordinary Hazard Group 1 classification, in accordance with National Fire Protection Association (NFPA) latest edition. The most commonly used NFPA standards relative to automatic sprinkler systems are: 13, 20, 25, 231, 231C, 318, and 750. Fire alarm systems shall be designed with a minimum standby power (battery) capacity. These batteries shall be capable of maintaining the entire system in a non-alarm condition for 24 hours, in addition to 15 minutes in full load alarm condition. The most commonly used NFPA standards relative to fire alarm systems are: 70, 72, 90A, and 318.

PART 1 SAFEGUARDS AND SECURITY

Direction for security issues related to the design of this project is taken from the current operating procedures of the laboratory activities.

During non-working hours, when the building is unoccupied, all exterior roll-up and personnel access doors into the building will be locked and security guards will regularly inspect the building during routine security patrols of the Fermilab site.

PART 2 ENERGY CONSERVATION

All elements of this project will be reviewed for energy conservation features that can be effectively incorporated into the overall building design. Energy conservation techniques and high efficiency equipment will be utilized wherever appropriate to minimize the total energy consumption of the building.

PART 3 HEALTH AND SAFETY

Exiting for the building will be provided in accordance with NFPA 101 Life Safety Code to assure adequate egress in the event of an emergency. The building will also be provided with portable fire extinguishers appropriate for the intended use of the building.

PART 4 ENVIRONMENTAL PROTECTION

The overall environmental impact of this project will be evaluated and reviewed as required to conform to all applicable portions of the National Environmental Policy Act (NEPA).

PART 5 DECONTAMINATION AND DECOMMISSIONING

Decontamination and decommissioning procedures are an important part of Fermilab environment, safety and health policies. These policies are described in Chapter 8070 of the Fermilab Environment, Safety and Health Manual. Appropriate decontamination and decommissioning procedures will be instituted for this project.

PART 6 QUALITY ASSURANCE

All aspects of this project will be periodically reviewed with regard to Quality Assurance issues from Conceptual Design through Title III completion. This review process will be completed in accordance with the applicable portions of the Fermilab Institutional Quality Assurance Program (FIQAP) currently under final development. The following elements will be included in the Fermilab Quality Assurance Program for the design and construction effort:

- An identification of staff assigned to this project with clear definition of responsibility levels and limit of authority as well as delineated lines of communication for exchange of information.
- Requirements for control of design criteria and criteria changes and recording of standards and codes used in the development of the criteria.
- Periodic review of design process, drawings and specification to insure compliance with accepted design criteria.
- Identification of underground utilities and facility interface points prior to the commencement of any construction in affected areas.
- Conformance to procedures regarding project updating and compliance with the approved construction schedule.
- Conformance to procedures regarding the review and approval of shop drawings, samples test results and other required submittals.
- Conformance to procedures for site inspection by Fermilab personnel to record construction progress and adherence to the approved contract documents.
- Verification of project completion, satisfactory system start-up and final project acceptance

PART 7 MAINTENANCE AND OPERATION

When completed, this project will become the formal responsibility of the Fermilab Particle Physics Division. The completed project, the utilities and systems that support it, will be added to the overall laboratory maintenance and building inspection program of the Facilities Engineering Services Section. The Facilities Engineering Services Section and Particle Physics Division will coordinate all preventative maintenance, normal service and emergency repairs for the building.

The Building Research Board National Research Council states that if a building receives an adequate level of maintenance and repair funding, a steady-state situation should exist wherein the inventory would remain in a service condition that would neither decline nor improve and a maintenance and repair backlog would not develop. Maintenance is defined as the day-to-

day work necessary to sustain property in order to realize the originally anticipated useful life of a fixed asset. Maintenance includes periodic inspection, adjustment, lubrication, and cleaning (non janitorial) of equipment, replacement of parts etc. to assure continuing service and to prevent breakdown. Repair is defined as the work required to restore damaged or worn-out property to a normal operating condition. In general, repairs are curative and maintenance is preventive.

Operations are the activities related to a building's normal performance of the function for which it is used. The cost of utilities, janitorial services, window cleaning, rodent control and waste management are generally included within the scope of operations and are not maintenance.

The following preliminary maintenance and repair costs forecast is based on information contained in the Whitestone Building and Repair Cost Reference 2002 escalated to FY2005 and indexed for the Chicago, Illinois area. The Building M&R Cost Profile is based on the Community Center model. While not an exact match, the functions and basic material selections are considered similar in nature to provide a preliminary forecast of maintenance and repair costs for this project.

Cost (FY2004)	Annual Cost Per Square Foot	Annual Cost as % of Replacement Cost
PM and Minor Repair	$1.00	1.04%
Unscheduled Maintenance	$1.15	1.18%
Renewal and Replacement	$3.03	3.12%
Total M&R Costs	**$5.18**	**5.34%**

If requested, a detailed maintenance and repair forecast for this project will be developed after the completion of Title 3. A copy of the referenced Whitestone Building and Repair Cost Reference data is included in the Appendix of this document.

PART 8 TELECOMMUNICATIONS

The existing Fermilab telephone communications network is adequate to provide normal telecommunication support to the new work.

PART 9 COMPUTER EQUIPMENT

Access to the central computing cluster, located in the Feynman Computing Center will be provided by extending the existing data communication network in the Main Ring ductbank.

PART 10 HANDICAPPED PROVISIONS

The applicable requirements of the Uniform Federal Accessibility Standards (UFAS), Americans with Disabilities Act (ADA) and the Americans with Disabilities Act Accessibility Guidelines (ADAAG) will be incorporated into the design of this project. Compliance with the ADA will be based upon an evaluation of the job descriptions and required tasks for the personnel assigned to work in this building. Those areas included in the scope of this project that will require accessibility as well as the established routes to those areas will be designed in full compliance with the existing statutes.

PART 11 EMERGENCY SHELTER PROVISIONS

Required provision for occupant protection in the event of tornadoes or other extreme weather conditions are provided within the existing building. Guidelines established by the Federal Emergency Management Agency (FEMA) in publications TR-83A and TR-83B will be used to assess the existing building and addition to insure safe areas within the building for the protection of building occupants.

APPLICABLE CODES, STANDARDS AND QUALITY LEVELS **C-0 Outfitting**

The design of this project will be in accordance with recognized architectural and engineering practice and will comply with the applicable portions of the of the U.S. Department of Energy and the State of Illinois codes, orders and regulation as incorporated into contract No. DE-AC02-76CH0300 between the US Department of Energy and Universities Research Association.

IDOT, Standard Specifications for Road and Bridge Construction, latest edition
IEPA, Illinois Urban Manual
AASHTO, American Association of State Highway and Transportation Officials
ASTM, American Society for Testing Materials
10 CFR Part 435 Subpart A / ASHRAE 90.1 – 1989
Clean Water Act
Safe Drinking Water Act
BOCA National Building Code
International Building Code 2000
NFPA - 101, Life Safety Code
State of Illinois accessibility standards
Americans with Disabilities Act (ADA)
Americans with Disabilities Act Accessibility Guidelines (ADAAG)
Uniform Federal Accessibility Standards (UFAS)
FEMA TR-83A, Interim Guidelines for Building Occupant Protection from Tornadoes and Extreme Winds
FEMA TR-83B, Tornado Protection - Selecting and Designing Safe Areas in Buildings
American Concrete Institute (ACI), Building Code Requirements for Structural Concrete, ACI 318, latest edition
ACI 530/ASCE 5/TMS 402 - Building Code Requirements for Masonry Structures; American Concrete Institute International; 1995.
ACI 530.1/ASCE 6/TMS 602 - Specification For Masonry Structures; American CRSI (Concrete Reinforcing Steel Institute)
American Institute of Steel Construction, Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, latest edition
ASTM (American Society for Testing and Materials)
AWS (American Welding Society)
SDI (Steel Deck Institute), Design Manual for Composite Decks, Form Decks and Roof Decks.
CFR (Code of Federal Regulations)
29 CFR 1910 Occupational Safety and Health Standards
29 CFR 1926 Safety and Health Regulations for Construction
77 IAC 890 (Illinois Plumbing Code)
ANSI/ASHRAE 14 (Mechanical refrigeration)
ANSI/ASME B31.5 (Refrigeration piping)
ANSI/ASME B31.8 (Gas transmission and piping systems)
ASME Pressure Vessel Code-Section VIII
ASME (American Society of Mechanical Engineers)
A17.1 Safety Code for Elevators and Escalators
NEMA (National Electrical Manufacturers Association)
NFPA (National Fire Protection Association)
NFPA 70 National Electric Code
NFPA 80 (National Fire Protection Agency) Fire Doors and Windows

Electrical: American National Standards Institute, National Electrical Safety Code, National Electrical Safety Code, ANSI C2, latest edition

Building Code Examination

Introduction

This is a building code examination for the B-TeV project at the existing C-0 Collision Hall. The project includes modifying the existing C-0 Collision Hall to accommodate three stories consisting of research laboratory, basement level consisting of mechanical support room, and a sub-basement consisting of a staging area. There will be an elevator for moving people and computer equipment. A typical computer floor is approximately 2,080 sq. ft., the mechanical support room is approximately 300 sq. ft., and the remaining area is 2,540 sq. ft. for a combined total of approximately 9,000 sq. ft. The structure will be approximately 35 feet in height above grade level, that is, of exposed wall and roof construction. The building construction primary consists of post-tension concrete and steel structural beams. There will be two stairways and three exterior doors constructed to accommodate egress. Finally, the building will be equipped with a fully automatic sprinkler system and fire alarm system. This examination excludes the Collision Hall.

Criteria Evaluation

The following was used for the model building code evaluation and requires independent reviews from Fermilab's outside fire protection engineering consultant and in-house comment and compliance review.

- DOE Order 420.1, Fire Protection – Section 4.2
- IBC, International Building Code, 2000 Edition
- NFPA 101, Life Safety Code, 2000 Edition
- NFPA 13, Standard of Installation of Automatic Sprinkler, 1999 Edition
- NFPA 70, National Electrical Code, 2002 Edition
- NFPA 72, Fire Alarm Code, 1999 Edition
- NFPA 75, Standard for the Protection of Information Technology, 2000 Edition
- NFPA 90A, Standard for Installation of Air-Conditioning, 1999 Edition
- ASHRAE Standard 90.1 - 1989
- ANSI 17.1 Safety Code for Elevators and Escalators, 2000 Edition
- Fermilab Environment, Safety and Health (ES&H) Manual
- Fermilab Engineering Standards

Examination

Occupancy Type

The uses will be limited to a research laboratory and as such, is classified by IBC Table 304 and NFPA 101 Section 3.3.134 as a Business Occupancy, "B".

APPLICABLE CODES, STANDARDS AND QUALITY LEVELS

Building Height and Area Limitations

The building will have a complete automatic sprinkler system and as such is allowed to be over three stories, limited to 60-feet in height, per the IBC. The building area is 9,000 square feet, less than the restricted 23,000 square feet permitted by IBC. Therefore, the building height and area is within the building area and height is within IBC Table 503 limitations.

Construction Type

In general, the building will be constructed of steel beams and concrete floors, unprotected and noncombustible. Therefore, the building is a Type II-B construction as defined by IBC, Section 602.2.

Wall and Floor Fire Separation

There is no requirement for fire rating the floors per IBC Section 602 and Section 713

Vertical Opening Fire Separation

The building will have three vertical openings that penetrate the main floors. These openings consist of two stairways and one elevator. The West stairway connecting all three stories will be constructed of a minimum of 1-hour fire resistive construction as defined by IBC Section 707 and 1003. The East stairway connecting all three stories and basements will be constructed of a minimum of 2-hour fire resistive construction as defined by IBC Section 707 and 1003. Both stairways will have a minimum width of 44-inches as outlined in IBC 1003.

The Elevator and utility shaft will be construction of a minimum of 2-hour fire resistive construction in accordance with IBC Section 707. The elevator will be classified as Limited-Use/Limited Application as defined by ANSI 17.1. Power disconnected will be provide in accordance with ANSI 17.1, Section 2.8 and the Emergency Operation and Signaling will comply with ANSI 17.1 Section 5.2.1.27.

Means of Egress

The building will have a minimum of two exits that discharge directly to the outside and two Stairwell exits that will also discharge directly to the outside serving the upper floors. The calculated occupant load for the building per NFPA 7.3.1.2 is 90 persons. The calculated occupant load is based on an occupant load factor of 1 person per 100 sq. ft gross floor area. The exit capacity is based on the exit doors, each having a clear width of 34-inches in accordance with NFPA 101, Section 7.2.1.2.2. The exit capacity can handle 850 persons and therefore, complies with IBC and NFPA egress requirements.

The travel distance length to an exit is 60-feet and is within the 300-feet limitation of NFPA 101, Section 38.2.6. The common path of travel is approximately 30-feet and is within the 75-feet limitation of NFP 101, Section 38.2.5.3. The dead corridor at column line 5 and C, is approximately 30-feet and is within the 50-feet limitation of NFPA 101, Section 38.2.5.2.

Fire Protection Systems

APPLICABLE CODES, STANDARDS AND QUALITY LEVELS

Automatic sprinkler systems will be an Ordinary Hazard Group I installed throughout the facility, and will be designed and installed in accordance with NFPA 13 and the Fermilab Engineering Standards. Fire alarm system will be installed throughout the facility and will be designed and installed in accordance with NFP 72 and the Fermilab Engineering Standards.

Other Building Components

Smoke detection will be installed below the raised computer floors and at the air handling units with automatic shut down of the air handling units, in accordance with NFPA 72, 75, and 90A. Exit signage and emergency lighting will be provided in accordance with NFPA 101. All electrical components will be installed in accordance NEC and Fermilab's standards. Lastly, all air handling and plumbing components will be installed in accordance with IBC, NFPA, ASHRA, and Illinois plumbing code.

LEED Analysis

The C-0 Outfitting project has been review for potential sustainable design features based on the LEED Project Checklist. A copy of the checklist is included in the appendix. At this time it is not anticipated that this project will pursue LEED certification but the design of the project will strive to conform to the principles of sustainable design. The LEED project checklist will be reviewed during each stage of the design to monitor progress on fulfilling the requirements of the credits that have been identified as achievable.

BTeV - WBS 3.0 C0 Building Outfitting

Total Construction Costs

Fermilab Labor: Salary, OPTO, Vacation, Fringe & Overhead

Non-Fermilab Labor: Salary, Benefits & Overhead

No Escalation, No Full material Procurement 'Burdening'

Activity ID	Activity Description	Duration	Labor and Material & Services Resource Information	Material & Services Cost	Labor Cost	Base Budget	Labor Contingency (%)	Materials & Services Contingency (%)	Labor Contingency ($)	Materials & Services Contingency ($)	Total Budget (Base + Contingency)
CONSTRUCTION											
				$4,896,576	**$1,084,177**	**$5,980,754**			**$216,835**	**$1,015,567**	**$7,213,157**
1 -- C-0 Outfitting Phase 1											
				$1,812,958	**$426,288**	**$2,239,246**			**$85,257**	**$362,591**	**$2,687,095**
1.1 -- Design to Award C-0 Phase 1											
				$66,515	**$166,537**	**$233,052**			**$33,307**	**$13,303**	**$279,663**
1.1.1 -- Title II EDIA FESS Phase 1											
				$0	**$166,537**	**$166,537**			**$33,307**	**$0**	**$199,844**
1.1.1	Title II EDIA FESS Phase 1	40d	BTEV.FNAL.FESS.EE,1976	$0	$166,537	$166,537	20%	0%	$33,307	$0	$199,844
1.1.2 -- Title II EDIA Consultant Phase 1											
				$66,515	**$0**	**$66,515**			**$0**	**$13,303**	**$79,818**
1.1.2	Title II EDIA Consultant Phase 1	30d	BTEV.FNAL.MANDS.BASE,57341	$66,515	$0	$66,515	0%	20%	$0	$13,303	$79,818
1.1.3 -- Construction Req.											
				$0	**$0**	**$0**			**$0**	**$0**	**$0**
1.1.3	Construction Req.	5d		$0	$0	$0	0%	20%	$0	$0	$0
1.1.4 -- Release for Bid											
				$0	**$0**	**$0**			**$0**	**$0**	**$0**
1.1.4	Release for Bid	5d		$0	$0	$0	0%	0%	$0	$0	$0
1.1.5 -- Pre-Bid Meeting											
				$0	**$0**	**$0**			**$0**	**$0**	**$0**
1.1.5	Pre-Bid Meeting	1d		$0	$0	$0	0%	0%	$0	$0	$0
1.1.6 -- Establish Source Criteria											
				$0	**$0**	**$0**			**$0**	**$0**	**$0**
1.1.6	Establish Source Criteria	3d		$0	$0	$0	0%	0%	$0	$0	$0
1.1.7 -- Receive Proposals											
				$0	**$0**	**$0**			**$0**	**$0**	**$0**
1.1.7	Receive Proposals	20d		$0	$0	$0	0%	0%	$0	$0	$0
1.1.8 -- Source Selection& Award											
				$0	**$0**	**$0**			**$0**	**$0**	**$0**
1.1.8	Source Selection& Award	15d		$0	$0	$0	0%	0%	$0	$0	$0
1.2 -- Title 3 EDIA C-0 Outfitting Phase 1											
				$0	**$259,750**	**$259,750**			**$51,950**	**$0**	**$311,701**
				$0	**$259,750**	**$259,750**			**$51,950**	**$0**	**$311,701**
1.2	Title 3 EDIA C-0 Outfitting Phase 1	435d	BTEV.FNAL.FESS.EE,3082	$0	$259,750	$259,750	20%	0%	$51,950	$0	$311,701
1.3 -- C-0 Outfitting Phase 1 Construction Contract											
				$1,746,442	**$0**	**$1,746,442**			**$0**	**$349,288**	**$2,095,731**

BTeV - WBS 3.0 C0 Building Outfitting

Total Construction Costs

Fermilab Labor: Salary, OPTO, Vacation, Fringe & Overhead

Non-Fermilab Labor: Salary, Benefits & Overhead

No Escalation, No Full material Procurement 'Burdening'

Activity ID	Activity Description	Duration	Labor and Material & Services Resource Information	Material & Services Cost	Labor Cost	Base Budget	Labor Contingency (%)	Materials & Services Contingency (%)	Labor Contingency ($)	Materials & Services Contingency ($)	Total Budget (Base + Contingency)
1.3.1 -- Notice to Proceed											
				$0	**$0**	**$0**			**$0**	**$0**	**$0**
1.3.1	Notice to Proceed	1d		$0	$0	$0	0%	0%	$0	$0	$0
1.3.2 -- Mobilize											
				$18,580	**$0**	**$18,580**			**$0**	**$3,716**	**$22,297**
1.3.2	Mobilize	10d	BTEV.FNAL.MANDS.BASE,16018	$18,580	$0	$18,580	0%	20%	$0	$3,716	$22,297
1.3.3 -- Site Concrete											
				$30,423	**$0**	**$30,423**			**$0**	**$6,084**	**$36,507**
1.3.3.1	S & A Concrete Mix	21d		$0	$0	$0	0%	0%	$0	$0	$0
1.3.3.2	S & A Rebar	21d		$0	$0	$0	0%	0%	$0	$0	$0
1.3.3.3	FBP Foundations at Stair	7d	BTEV.FNAL.MANDS.BASE,6075	$7,047	$0	$7,047	0%	20%	$0	$1,409	$8,456
1.3.3.8	Construct Hardstands	10d	BTEV.FNAL.MANDS.BASE,12265	$14,227	$0	$14,227	0%	20%	$0	$2,845	$17,072
1.3.3.10	Site Utilities	7d	BTEV.FNAL.MANDS.BASE,4800	$5,568	$0	$5,568	0%	20%	$0	$1,113	$6,681
1.3.3.11	Rework Temp Power	15d		$0	$0	$0	0%	20%	$0	$0	$0
1.3.3.12	Demo Int. Stair Enclosure	3d	BTEV.FNAL.MANDS.BASE,3087	$3,580	$0	$3,580	0%	20%	$0	$716	$4,297
1.3.4 -- Structural Steel & Weather Enclosures											
				$241,956	**$0**	**$241,956**			**$0**	**$48,391**	**$290,347**
1.3.4.1	S & A Steel Shop Drawings	20d		$0	$0	$0	0%	0%	$0	$0	$0
1.3.4.2	Fab and ship Steel	30d		$0	$0	$0	0%	0%	$0	$0	$0
1.3.4.3	Erect Structural Steel	10d	BTEV.FNAL.MANDS.BASE,56702	$65,774	$0	$65,774	0%	20%	$0	$13,154	$78,929
1.3.4.4	Install Steel Stairs and misc.	4d	BTEV.FNAL.MANDS.BASE,36224	$42,019	$0	$42,019	0%	20%	$0	$8,403	$50,423
1.3.4.5	Siding & Roofing	17d	BTEV.FNAL.MANDS.BASE,56078	$65,050	$0	$65,050	0%	20%	$0	$13,010	$78,060
1.3.4.6	Electronics Bridge	20d	BTEV.FNAL.MANDS.BASE,59579	$69,111	$0	$69,111	0%	20%	$0	$13,822	$82,933
1.3.5 -- Structural Concrete											
				$108,566	**$0**	**$108,566**			**$0**	**$21,713**	**$130,280**
1.3.5.1	S & A Rebar and Tendons.	21d		$0	$0	$0	0%	0%	$0	$0	$0
1.3.5.2	Fab Rebar and Tendons	14d		$0	$0	$0	0%	0%	$0	$0	$0
1.3.5.3	FBP Concrete @ El. 744'	20d	BTEV.FNAL.MANDS.BASE,46796	$54,283	$0	$54,283	0%	20%	$0	$10,856	$65,140
1.3.5.4	FBP Concrete @ El 764'	20d	BTEV.FNAL.MANDS.BASE,46796	$54,283	$0	$54,283	0%	20%	$0	$10,856	$65,140
1.3.6 -- Concrete Masonry											
				$151,057	**$0**	**$151,057**			**$0**	**$30,211**	**$181,269**
1.3.6.1	S & A Masonry SD	21d		$0	$0	$0	0%	0%	$0	$0	$0
1.3.6.2	S & A Doors and Glass	21d		$0	$0	$0	0%	0%	$0	$0	$0
1.3.6.3	Concrete Masonry El 715-0	9d	BTEV.FNAL.MANDS.BASE,9581	$11,113	$0	$11,113	0%	20%	$0	$2,222	$13,336
1.3.6.4	Concrete Masonry El 731'-4	15d	BTEV.FNAL.MANDS.BASE,14371	$16,670	$0	$16,670	0%	20%	$0	$3,334	$20,004
1.3.6.5	Concrete Masonry El 746-6	12d	BTEV.FNAL.MANDS.BASE,23952	$27,784	$0	$27,784	0%	20%	$0	$5,556	$33,341
1.3.6.6	Concrete Masonry El 755-4	9d	BTEV.FNAL.MANDS.BASE,23952	$27,784	$0	$27,784	0%	20%	$0	$5,556	$33,341
1.3.6.7	Concrete Masonry El 766-0	9d	BTEV.FNAL.MANDS.BASE,23952	$27,784	$0	$27,784	0%	20%	$0	$5,556	$33,341
1.3.6.8	Install Doors and Glass	6d	BTEV.FNAL.MANDS.BASE,34414	$39,920	$0	$39,920	0%	20%	$0	$7,984	$47,904

BTeV - WBS 3.0 C0 Building Outfitting

Total Construction Costs

Fermilab Labor: Salary, OPTO, Vacation, Fringe & Overhead

Non-Fermilab Labor: Salary, Benefits & Overhead

No Escalation, No Full material Procurement 'Burdening'

Activity ID	Activity Description	Duration	Labor and Material & Services Resource Information	Material & Services Cost	Labor Cost	Base Budget	Labor Contingency (%)	Materials & Services Contingency (%)	Labor Contingency ($)	Materials & Services Contingency ($)	Total Budget (Base + Contingency)
1.3.7 -- Conveying System											
				$152,488	**$0**	**$152,488**			**$0**	**$30,497**	**$182,985**
1.3.7.1	S & A Elevator SD	50d		$0	$0	$0	0%	0%	$0	$0	$0
1.3.7.2	Fab and Del elev Rails	25d		$0	$0	$0	0%	0%	$0	$0	$0
1.3.7.3	Install elev rails	10d	BTEV.MANDSEXEMPT,28400	$28,400	$0	$28,400	0%	20%	$0	$5,680	$34,080
1.3.7.4	Install Elevator Machine Rm	15d	BTEV.MANDSEXEMPT,56801	$56,801	$0	$56,801	0%	20%	$0	$11,360	$68,161
1.3.7.5	Demo Roof	2d	BTEV.MANDSEXEMPT,1185	$1,185	$0	$1,185	0%	20%	$0	$237	$1,422
1.3.7.6	Frame, Side & Roof Elevator Head house	10d	BTEV.MANDSEXEMPT,9301	$9,301	$0	$9,301	0%	20%	$0	$1,860	$11,161
1.3.7.7	Install Elevator Cab	10d	BTEV.MANDSEXEMPT,56801	$56,801	$0	$56,801	0%	20%	$0	$11,360	$68,161
1.3.7.8	Energize and Test Elevator	2d		$0	$0	$0	0%	20%	$0	$0	$0
1.3.8 -- Finishes											
				$76,724	**$0**	**$76,724**			**$0**	**$15,344**	**$92,068**
1.3.8.1	Paint Block Walls	10d	BTEV.MANDSEXEMPT,18769	$18,769	$0	$18,769	0%	20%	$0	$3,753	$22,522
1.3.8.2	Paint Doors & Glass Frames	4d	BTEV.MANDSEXEMPT,10959	$10,959	$0	$10,959	0%	20%	$0	$2,191	$13,150
1.3.8.3	Rough In Toilet Rm Plumbing	10d	BTEV.MANDSEXEMPT,23498	$23,498	$0	$23,498	0%	20%	$0	$4,699	$28,197
1.3.8.4	Toilet RM Walls	7d		$0	$0	$0	0%	20%	$0	$0	$0
1.3.8.5	Toilet Rm Finishes	15d		$0	$0	$0	0%	20%	$0	$0	$0
1.3.8.6	Trim out Toilet Rm. Fixtures	4d	BTEV.MANDSEXEMPT,23498	$23,498	$0	$23,498	0%	20%	$0	$4,699	$28,197
1.3.14 -- Fire Protection											
				$170,870	**$0**	**$170,870**			**$0**	**$34,174**	**$205,043**
1.3.14.1	Install Fire Riser to High Bay	4d	BTEV.MANDSEXEMPT,17087	$17,087	$0	$17,087	0%	20%	$0	$3,417	$20,504
1.3.14.2	Install Fire Riser to Side bay	4d	BTEV.MANDSEXEMPT,17087	$17,087	$0	$17,087	0%	20%	$0	$3,417	$20,504
1.3.14.3	Rough In Sprinklers El 731'-4"	5d	BTEV.MANDSEXEMPT,17087	$17,087	$0	$17,087	0%	20%	$0	$3,417	$20,504
1.3.14.4	Rough In sprinklers El 746'-6	10d	BTEV.MANDSEXEMPT,17087	$17,087	$0	$17,087	0%	20%	$0	$3,417	$20,504
1.3.14.5	Rough In Sprinklers El.755'-4	5d	BTEV.MANDSEXEMPT,17087	$17,087	$0	$17,087	0%	20%	$0	$3,417	$20,504
1.3.14.6	Rough In Sprinklers El 766'-0	10d	BTEV.MANDSEXEMPT,17087	$17,087	$0	$17,087	0%	20%	$0	$3,417	$20,504
1.3.14.7	Trim Out Sprinklers El 731'-4"	4d	BTEV.MANDSEXEMPT,17087	$17,087	$0	$17,087	0%	20%	$0	$3,417	$20,504
1.3.14.8	Trim Out sprinklers El 746'-6	4d	BTEV.MANDSEXEMPT,17087	$17,087	$0	$17,087	0%	20%	$0	$3,417	$20,504
1.3.14.9	Trim Out Sprinklers El.755'-4	4d	BTEV.MANDSEXEMPT,17087	$17,087	$0	$17,087	0%	20%	$0	$3,417	$20,504
1.3.14.10	Trim Out Sprinklers El 766'-0	4d	BTEV.MANDSEXEMPT,17087	$17,087	$0	$17,087	0%	20%	$0	$3,417	$20,504
1.3.15 -- Fire Detection											
				$98,783	**$0**	**$98,783**			**$0**	**$19,756**	**$118,539**
1.3.15.1	Fire Detection El 731'-4"	17d	BTEV.MANDSEXEMPT,9878	$9,878	$0	$9,878	0%	20%	$0	$1,975	$11,853
1.3.15.2	Fire Detection El 746'-6	10d	BTEV.MANDSEXEMPT,19757	$19,757	$0	$19,757	0%	20%	$0	$3,951	$23,708
1.3.15.3	Fire Detection El.755'-4	10d	BTEV.MANDSEXEMPT,19757	$19,757	$0	$19,757	0%	20%	$0	$3,951	$23,708
1.3.15.4	Fire Detection El 766'-0	10d	BTEV.MANDSEXEMPT,19757	$19,757	$0	$19,757	0%	20%	$0	$3,951	$23,708
1.3.15.5	Upgrade Fire Control Panel	4d	BTEV.MANDSEXEMPT,9878	$9,878	$0	$9,878	0%	20%	$0	$1,975	$11,853
1.3.15.6	Test All Fire Detection	3d	BTEV.MANDSEXEMPT,9878	$9,878	$0	$9,878	0%	20%	$0	$1,975	$11,853
1.3.15.7	Fire Detection Collision Hall	10d	BTEV.MANDSEXEMPT,9878	$9,878	$0	$9,878	0%	20%	$0	$1,975	$11,853
1.3.16 -- Power Distribution and Lighting											

BTeV - WBS 3.0 C0 Building Outfitting

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No Escalation, No Full material Procurement 'Burdening'

Activity ID	Activity Description	Duration	Labor and Material & Services Resource Information	Material & Services Cost	Labor Cost	Base Budget	Labor Contingency (%)	Materials & Services Contingency (%)	Labor Contingency ($)	Materials & Services Contingency ($)	Total Budget (Base + Contingency)
				$262,715	$0	$262,715			$0	$52,543	$315,258
1.3.16.1	S & A Electrical Devices	90d		$0	$0	$0	0%	0%	$0	$0	$0
1.3.16.2	Rough In House Power El 715'-0	25d	BTEV.MANDSEXEMPT,80659	$80,659	$0	$80,659	0%	20%	$0	$16,131	$96,790
1.3.16.7	Coll Hall Power	15d	BTEV.MANDSEXEMPT,91439	$91,439	$0	$91,439	0%	20%	$0	$18,287	$109,726
1.3.16.8	Trim Out House Power El 715'-0	20d	BTEV.MANDSEXEMPT,80659	$80,659	$0	$80,659	0%	20%	$0	$16,131	$96,790
1.3.16.13	Install Exist. 2000 Amp Switchbd	14d	BTEV.MANDSEXEMPT,9958	$9,958	$0	$9,958	0%	20%	$0	$1,991	$11,949
1.3.16.14	Pull and terminate secondary	6d		$0	$0	$0	0%	20%	$0	$0	$0
1.3.18 -- Feeder From B-4 to C-0											
				$434,278	$0	$434,278			$0	$86,855	$521,133
1.3.18.1	Concrete and Rebar SD	21d		$0	$0	$0	0%	0%	$0	$0	$0
1.3.18.2	Install Duct bank B-4 to Berm	7d	BTEV.MANDSEXEMPT,42838	$42,838	$0	$42,838	0%	20%	$0	$8,567	$51,405
1.3.18.3	Jack Carrier pipe thru berm	7d	BTEV.MANDSEXEMPT,21420	$21,420	$0	$21,420	0%	20%	$0	$4,284	$25,704
1.3.18.5	Install duct bank MH to C-0 Pad	14d	BTEV.MANDSEXEMPT,42838	$42,838	$0	$42,838	0%	20%	$0	$8,567	$51,405
1.3.18.6	Install secondary duct bank	9d	BTEV.MANDSEXEMPT,149908	$149,908	$0	$149,908	0%	20%	$0	$29,981	$179,889
1.3.18.7	Install Pad, C-0 Test Area	14d	BTEV.MANDSEXEMPT,53652	$53,652	$0	$53,652	0%	20%	$0	$10,730	$64,382
1.3.18.8	Install switch Pad at B-4	5d		$0	$0	$0	0%	20%	$0	$0	$0
1.3.18.9	Set switch at B-4	1d	BTEV.MANDSEXEMPT,2400	$2,400	$0	$2,400	0%	20%	$0	$480	$2,880
1.3.18.10	Set Transformers C-0	3d	BTEV.MANDSEXEMPT,25200	$25,200	$0	$25,200	0%	20%	$0	$5,040	$30,240
1.3.18.11	Set Switch C-0 Test	1d	BTEV.MANDSEXEMPT,2400	$2,400	$0	$2,400	0%	20%	$0	$480	$2,880
1.3.18.12	Set Generator C-0 Test	1d	BTEV.MANDSEXEMPT,75531	$75,531	$0	$75,531	0%	20%	$0	$15,106	$90,637
1.3.18.14	Pull Feeder B-4 to C-0 Test Area	3d		$0	$0	$0	0%	20%	$0	$0	$0
1.3.18.15	Terminate Primary	1d		$0	$0	$0	0%	20%	$0	$0	$0
1.3.18.16	Rerack Main Ring Manholes	15d	BTEV.MANDSEXEMPT,18091	$18,091	$0	$18,091	0%	20%	$0	$3,618	$21,709
2 -- C-0 Outfitting Phase 2											
				$1,859,031	$444,071	$2,303,102			$88,814	$408,058	$2,799,975
2.1 -- Design to Award C-0 Phase 2											
				$46,400	$187,185	$233,585			$37,437	$9,280	$280,303
2.1.1 -- Title II EDIA FESS											
				$0	$187,185	$187,185			$37,437	$0	$224,623
2.1.1	Title II EDIA FESS	50d	BTEV.FNAL.FESS.EE,2221	$0	$187,185	$187,185	20%	0%	$37,437	$0	$224,623
2.1.2 -- Title II EDIA Consultant											
				$46,400	$0	$46,400			$0	$9,280	$55,680
2.1.2	Title II EDIA Consultant	40d	BTEV.FNAL.MANDS.BASE,40000	$46,400	$0	$46,400	0%	20%	$0	$9,280	$55,680
2.1.3 -- Construction Req.											
				$0	$0	$0			$0	$0	$0
2.1.3	Construction Req.	5d		$0	$0	$0	0%	0%	$0	$0	$0
2.1.4 -- Release for Bid											
				$0	$0	$0			$0	$0	$0
2.1.4	Release for Bid	5d		$0	$0	$0	0%	0%	$0	$0	$0

BTeV - WBS 3.0 C0 Building Outfitting

Total Construction Costs

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Non-Fermilab Labor: Salary, Benefits & Overhead

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Activity ID	Activity Description	Duration	Labor and Material & Services Resource Information	Material & Services Cost	Labor Cost	Base Budget	Labor Contingency (%)	Materials & Services Contingency (%)	Labor Contingency ($)	Materials & Services Contingency ($)	Total Budget (Base + Contingency)
2.1.5 -- Pre- Bid Meeting											
				$0	**$0**	**$0**			**$0**	**$0**	**$0**
2.1.5	Pre- Bid Meeting	1d		$0	$0	$0	0%	0%	$0	$0	$0
2.1.6 -- Establish Source Criteria											
				$0	**$0**	**$0**			**$0**	**$0**	**$0**
2.1.6	Establish Source Criteria	3d		$0	$0	$0	0%	0%	$0	$0	$0
2.1.7 -- Receive Proposals											
				$0	**$0**	**$0**			**$0**	**$0**	**$0**
2.1.7	Receive Proposals	25d		$0	$0	$0	0%	0%	$0	$0	$0
2.1.8 -- Source Selection& Award											
				$0	**$0**	**$0**			**$0**	**$0**	**$0**
2.1.8	Source Selection& Award	15d		$0	$0	$0	0%	0%	$0	$0	$0
2.2 -- Title 3 EDIA C-0 Outfitting Phase 2											
				$0	**$256,885**	**$256,885**			**$51,377**	**$0**	**$308,262**
				$0	**$256,885**	**$256,885**			**$51,377**	**$0**	**$308,262**
2.2	Title 3 EDIA C-0 Outfitting Phase 2	0	BTEV.FNAL.FESS.EE,3048	$0	$256,885	$256,885	20%	0%	$51,377	$0	$308,262
2.3 -- C-0 Outfitting Phase 2 Construction Contract											
				$1,812,631	**$0**	**$1,812,631**			**$0**	**$398,778**	**$2,211,410**
2.3.1 -- Notice to Proceed											
				$0	**$0**	**$0**			**$0**	**$0**	**$0**
2.3.1	Notice to Proceed	0		$0	$0	$0	0%	0%	$0	$0	$0
2.3.2 -- Mobilize											
				$0	**$0**	**$0**			**$0**	**$0**	**$0**
2.3.2	Mobilize	0		$0	$0	$0	0%	0%	$0	$0	$0
2.3.3 -- Site Concrete											
				$114,016	**$0**	**$114,016**			**$0**	**$25,083**	**$139,100**
2.3.3.4	FBP Chiller Pads	5d	BTEV.FNAL.MANDS.BASE,29635	$34,376	$0	$34,376	0%	22%	$0	$7,562	$41,939
2.3.3.5	FBP Condenser Pads	7d	BTEV.FNAL.MANDS.BASE,44453	$51,565	$0	$51,565	0%	22%	$0	$11,344	$62,909
2.3.3.6	Construct Gas House	12d	BTEV.FNAL.MANDS.BASE,24202	$28,074	$0	$28,074	0%	22%	$0	$6,176	$34,250
2.3.6 -- Masonry											
				$50,689	**$0**	**$50,689**			**$0**	**$11,151**	**$61,841**
2.3.6.1	S & A Finishes	21d		$0	$0	$0	0%	0%	$0	$0	$0
2.3.6.9	C-0 Service Bldg. Mods	7d	BTEV.FNAL.MANDS.BASE,10111	$11,728	$0	$11,728	0%	22%	$0	$2,580	$14,309
2.3.6.10	C-0 SB Buss Duct Enclosure	10d	BTEV.FNAL.MANDS.BASE,33587	$38,960	$0	$38,960	0%	22%	$0	$8,571	$47,532
2.3.8 -- Finishes											
				$221,492	**$0**	**$221,492**			**$0**	**$48,728**	**$270,221**
2.3.8.2	Fab and Deliver Finishes	40d		$0	$0	$0	0%	0%	$0	$0	$0
2.3.8.7	Flooring & Carpeting El 755'-4	4d	BTEV.FNAL.MANDS.BASE,14256	$16,536	$0	$16,536	0%	22%	$0	$3,638	$20,175

BTeV - WBS 3.0 C0 Building Outfitting

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Activity ID	Activity Description	Duration	Labor and Material & Services Resource Information	Material & Services Cost	Labor Cost	Base Budget	Labor Contingency (%)	Materials & Services Contingency (%)	Labor Contingency ($)	Materials & Services Contingency ($)	Total Budget (Base + Contingency)
2.3.8.8	Install Computer Floor El 746'-6	10d	BTEV.FNAL.MANDS.BASE,62795	$72,842	$0	$72,842	0%	22%	$0	$16,025	$88,867
2.3.8.9	Install Computer Floor El. 766'-0	10d	BTEV.FNAL.MANDS.BASE,62795	$72,842	$0	$72,842	0%	22%	$0	$16,025	$88,867
2.3.8.10	C-0 Service Bldg. Mods	25d	BTEV.FNAL.MANDS.BASE,51096	$59,271	$0	$59,271	0%	22%	$0	$13,039	$72,311
2.3.9 -- HVAC System											
				$475,946	**$0**	**$475,946**			**$0**	**$104,708**	**$580,654**
2.3.9.1	S & A HVAC Units	21d		$0	$0	$0	0%	0%	$0	$0	$0
2.3.9.2	F & D HVAC Units	30d		$0	$0	$0	0%	0%	$0	$0	$0
2.3.9.3	Install HVAC Units Coll. Hall & Assem Hall	15d	BTEV.FNAL.MANDS.BASE,69149	$80,212	$0	$80,212	0%	22%	$0	$17,646	$97,859
2.3.9.4	Install HVAC Units + Off & MUA	10d	BTEV.FNAL.MANDS.BASE,30098	$34,913	$0	$34,913	0%	22%	$0	$7,681	$42,594
2.3.9.5	Collision Hall work, (Duct, fancoil, Piping	3d	BTEV.FNAL.MANDS.BASE,32105	$37,241	$0	$37,241	0%	22%	$0	$8,193	$45,434
2.3.9.6	Duct Work	6d	BTEV.FNAL.MANDS.BASE,66438	$77,068	$0	$77,068	0%	22%	$0	$16,954	$94,023
2.3.9.7	Install Ductwk El 755'-4"	15d	BTEV.FNAL.MANDS.BASE,9878	$11,458	$0	$11,458	0%	22%	$0	$2,520	$13,979
2.3.9.8	Install Motorized Dampers and Louvers	5d	BTEV.FNAL.MANDS.BASE,12348	$14,323	$0	$14,323	0%	22%	$0	$3,151	$17,474
2.3.9.9	Comm. and Training HVAC	1d	BTEV.MANDSEXEMPT,18522	$18,522	$0	$18,522	0%	22%	$0	$4,074	$22,596
2.3.9.10	Insulate Ductwork	4d	BTEV.MANDSEXEMPT,37044	$37,044	$0	$37,044	0%	22%	$0	$8,149	$45,193
2.3.9.11	Install Toilet Room Exhaust	2d	BTEV.MANDSEXEMPT,3704	$3,704	$0	$3,704	0%	22%	$0	$814	$4,518
2.3.9.12	Install Mech Rom Exhaust	2d	BTEV.MANDSEXEMPT,6174	$6,174	$0	$6,174	0%	22%	$0	$1,358	$7,532
2.3.9.13	Install DCW pipe and Humidifier	2d	BTEV.MANDSEXEMPT,14818	$14,818	$0	$14,818	0%	22%	$0	$3,259	$18,077
2.3.9.14	Balance HVAC System, Assy, Off & MUA	2d	BTEV.MANDSEXEMPT,5704	$5,704	$0	$5,704	0%	22%	$0	$1,254	$6,958
2.3.9.15	Balance HVAC Sys. Col Hall	2d	BTEV.MANDSEXEMPT,2444	$2,444	$0	$2,444	0%	22%	$0	$537	$2,981
2.3.9.16	Install Sensors and Controls	5d	BTEV.MANDSEXEMPT,58344	$58,344	$0	$58,344	0%	22%	$0	$12,835	$71,179
2.3.9.17	Start Up and Comm (Non Shutdowwn Related)	4d	BTEV.MANDSEXEMPT,19244	$19,244	$0	$19,244	0%	22%	$0	$4,233	$23,477
2.3.9.18	Start Up and Comm (Shutdown Related)	10d	BTEV.MANDSEXEMPT,19244	$19,244	$0	$19,244	0%	22%	$0	$4,233	$23,477
2.3.9.19	Install Bridge HVAC Unit Piping and Startup	4d	BTEV.MANDSEXEMPT,12348	$12,348	$0	$12,348	0%	22%	$0	$2,716	$15,064
2.3.9.20	Install CRAC Condensing Unit AC for El 746	6d	BTEV.MANDSEXEMPT,16719	$16,719	$0	$16,719	0%	22%	$0	$3,678	$20,397
2.3.9.21	Install Ref Piping Test, Fill and Charge Ins and Startup	4d	BTEV.MANDSEXEMPT,6419	$6,419	$0	$6,419	0%	22%	$0	$1,412	$7,831
2.3.10 -- Chilled Water System (CHW)											
				$281,095	**$0**	**$281,095**			**$0**	**$61,840**	**$342,935**
2.3.10.1	S & A Chillers, W/ Controls	21d		$0	$0	$0	0%	0%	$0	$0	$0
2.3.10.2	F & D Chillers W/ Controls	50d		$0	$0	$0	0%	0%	$0	$0	$0
2.3.10.3	S & A Chilled Water Pumps	21d		$0	$0	$0	0%	0%	$0	$0	$0
2.3.10.4	F & D Chilled Water Pumps	36d		$0	$0	$0	0%	0%	$0	$0	$0
2.3.10.5	Install Chillers	3d	BTEV.MANDSEXEMPT,110416	$110,416	$0	$110,416	0%	22%	$0	$24,291	$134,707
2.3.10.6	Install Chilled Water Pumps	5d	BTEV.MANDSEXEMPT,4229	$4,229	$0	$4,229	0%	22%	$0	$930	$5,159
2.3.10.7	Install CHW piping supports and Fittings	10d	BTEV.MANDSEXEMPT,43909	$43,909	$0	$43,909	0%	22%	$0	$9,659	$53,568
2.3.10.8	Install Tanks and Othere Hydronic items	10d	BTEV.MANDSEXEMPT,11082	$11,082	$0	$11,082	0%	22%	$0	$2,438	$13,520
2.3.10.9	Install ECW pipe header on 756 Comp Rm.	6d	BTEV.MANDSEXEMPT,17100	$17,100	$0	$17,100	0%	22%	$0	$3,762	$20,862
2.3.10.10	Leak test and Insulate ECW Header	4d	BTEV.MANDSEXEMPT,5700	$5,700	$0	$5,700	0%	22%	$0	$1,254	$6,954
2.3.10.11	Leak test & Insulate CHW	6d	BTEV.MANDSEXEMPT,9567	$9,567	$0	$9,567	0%	22%	$0	$2,104	$11,671
2.3.10.12	Install Sensors and Controls	6d	BTEV.MANDSEXEMPT,49593	$49,593	$0	$49,593	0%	22%	$0	$10,910	$60,503

BTeV - WBS 3.0 C0 Building Outfitting
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2.3.10.13	Flush tag and Fill System	1d	BTEV.MANDSEXEMPT,3704	$3,704	$0	$3,704	0%	22%	$0	$814	$4,518
2.3.10.14	Startup & Bal CHW	1d	BTEV.MANDSEXEMPT,3257	$3,257	$0	$3,257	0%	22%	$0	$716	$3,973
2.3.10.15	Comm and Training	5d	BTEV.MANDSEXEMPT,22538	$22,538	$0	$22,538	0%	22%	$0	$4,958	$27,496
2.3.11 -- High Density Computer Cooling											
				$235,183	**$0**	**$235,183**			**$0**	**$51,740**	**$286,923**
2.3.11.1	S & A Computer Rm. Air Handlers	21d		$0	$0	$0	0%	0%	$0	$0	$0
2.3.11.2	F & D Computer Room Air handlers	30d		$0	$0	$0	0%	0%	$0	$0	$0
2.3.11.3	Install Comp. Rm Condensers pad mnt.	12d	BTEV.MANDSEXEMPT,81497	$81,497	$0	$81,497	0%	22%	$0	$17,929	$99,426
2.3.11.4	Install Comp room Air handlers El; 766	12d	BTEV.MANDSEXEMPT,93143	$93,143	$0	$93,143	0%	22%	$0	$20,491	$113,634
2.3.11.5	Ref. Piping CRAC	8d	BTEV.MANDSEXEMPT,14818	$14,818	$0	$14,818	0%	22%	$0	$3,259	$18,077
2.3.11.6	Leak Test and Charge Ref Piping	4d	BTEV.MANDSEXEMPT,3754	$3,754	$0	$3,754	0%	22%	$0	$825	$4,579
2.3.11.7	Install DCW & Humidifier	2d	BTEV.MANDSEXEMPT,11113	$11,113	$0	$11,113	0%	22%	$0	$2,444	$13,557
2.3.11.8	Insulate and Tag Piping	3d	BTEV.MANDSEXEMPT,14510	$14,510	$0	$14,510	0%	22%	$0	$3,192	$17,702
2.3.11.9	Install Controls	4d	BTEV.MANDSEXEMPT,12965	$12,965	$0	$12,965	0%	22%	$0	$2,852	$15,817
2.3.11.10	Startup Balance Comm and Training	2d	BTEV.MANDSEXEMPT,3383	$3,383	$0	$3,383	0%	22%	$0	$744	$4,127
2.3.12 -- 746'-6 Computer Room Cooling											
				$0	**$0**	**$0**			**$0**	**$0**	**$0**
2.3.12.1	S & A Computer Room Heat Exchanger	21d		$0	$0	$0	0%	0%	$0	$0	$0
2.3.12.2	F & D HeatExger + 8 Pumps	30d		$0	$0	$0	0%	0%	$0	$0	$0
2.3.12.3	Install HeatExger	10d		$0	$0	$0	0%	22%	$0	$0	$0
2.3.12.4	Install Piping El 746'-6 System	30d		$0	$0	$0	0%	22%	$0	$0	$0
2.3.12.6	Test and Balance El 746	5d		$0	$0	$0	0%	22%	$0	$0	$0
2.3.12.7	Commissioning and Training El 746	1d		$0	$0	$0	0%	20%	$0	$0	$0
2.3.13 -- Motor Control Center (MCC)											
				$32,863	**$0**	**$32,863**			**$0**	**$7,229**	**$40,092**
2.3.13.1	S & A MCC	21d		$0	$0	$0	0%	0%	$0	$0	$0
2.3.13.2	F & D Motor Control Center	30d		$0	$0	$0	0%	22%	$0	$0	$0
2.3.13.3	Install Motor Control Center	30d	BTEV.MANDSEXEMPT,32863	$32,863	$0	$32,863	0%	22%	$0	$7,229	$40,092
2.3.16 -- Power Distribution and Lighting											
				$217,270	**$0**	**$217,270**			**$0**	**$47,799**	**$265,069**
2.3.16.1	S & A Material Submittals	21d		$0	$0	$0	0%	0%	$0	$0	$0
2.3.16.2	Fab and Del.	45d		$0	$0	$0	0%	0%	$0	$0	$0
2.3.16.3	Rough In Power & Lighting El 731	20d	BTEV.MANDSEXEMPT,45322	$45,322	$0	$45,322	0%	22%	$0	$9,970	$55,292
2.3.16.4	Rough In Power & Lighting El 746'-6	15d	BTEV.MANDSEXEMPT,11114	$11,114	$0	$11,114	0%	22%	$0	$2,445	$13,559
2.3.16.5	Rough In Power & Lighting El. 755'-4	15d	BTEV.MANDSEXEMPT,24977	$24,977	$0	$24,977	0%	22%	$0	$5,494	$30,471
2.3.16.6	Rough In Power & Lighting El 766'-0	15d	BTEV.MANDSEXEMPT,27222	$27,222	$0	$27,222	0%	22%	$0	$5,988	$33,210
2.3.16.9	Trim Out House Power El 731'-0	10d	BTEV.MANDSEXEMPT,45322	$45,322	$0	$45,322	0%	22%	$0	$9,970	$55,292
2.3.16.10	Trim Out Power & Lighting El 746'-6	10d	BTEV.MANDSEXEMPT,11114	$11,114	$0	$11,114	0%	22%	$0	$2,445	$13,559
2.3.16.11	Trim Out Power & Lighting El. 755'-4	10d	BTEV.MANDSEXEMPT,24977	$24,977	$0	$24,977	0%	22%	$0	$5,494	$30,471
2.3.16.12	Trim Out Power & Lighting El 766'-0	10d	BTEV.MANDSEXEMPT,27222	$27,222	$0	$27,222	0%	22%	$0	$5,988	$33,210

BTeV - WBS 3.0 C0 Building Outfitting

Total Construction Costs

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2.3.17 -- Side Bay Computer Power											
				$184,075	**$0**	**$184,075**			**$0**	**$40,496**	**$224,571**
2.3.17.1	Install User Panels El 746'-6	8d	BTEV.MANDSEXEMPT,73474	$73,474	$0	$73,474	0%	22%	$0	$16,164	$89,638
2.3.17.3	Install User Panels El. 766'-0	30d	BTEV.MANDSEXEMPT,110601	$110,601	$0	$110,601	0%	22%	$0	$24,332	$134,933
2.3.17.4	Punch List	11d		$0	$0	$0	0%	22%	$0	$0	$0
2.3.17.5	Commision Coll. Hall	5d		$0	$0	$0	0%	22%	$0	$0	$0
3 -- C Sector High Voltage Power Upgrade											
				$599,249	**$175,470**	**$774,720**			**$35,094**	**$119,849**	**$929,664**
3.1 -- Design to Award C Sector High Voltage											
				$62,060	**$25,452**	**$87,512**			**$5,090**	**$12,412**	**$105,015**
3.1.1 -- Title II EDIA FESS Engineering											
				$0	**$25,452**	**$25,452**			**$5,090**	**$0**	**$30,543**
3.1.1	Title II EDIA FESS Engineering	40d	BTEV.FNAL.FESS.EE,302	$0	$25,452	$25,452	20%	0%	$5,090	$0	$30,543
3.1.2 -- Title II EDIA Consultant Eng.											
				$62,060	**$0**	**$62,060**			**$0**	**$12,412**	**$74,472**
3.1.2	Title II EDIA Consultant Eng.	40d	BTEV.FNAL.MANDS.BASE,53500	$62,060	$0	$62,060	0%	20%	$0	$12,412	$74,472
3.1.3 -- Construction Req.											
				$0	**$0**	**$0**			**$0**	**$0**	**$0**
3.1.3	Construction Req.	10d		$0	$0	$0	0%	20%	$0	$0	$0
3.1.4 -- Release for Bid											
				$0	**$0**	**$0**			**$0**	**$0**	**$0**
3.1.4	Release for Bid	10d		$0	$0	$0	0%	20%	$0	$0	$0
3.1.5 -- Pre- Bid Meeting											
				$0	**$0**	**$0**			**$0**	**$0**	**$0**
3.1.5	Pre- Bid Meeting	1d		$0	$0	$0	0%	20%	$0	$0	$0
3.1.6 -- Establish Source Criteria											
				$0	**$0**	**$0**			**$0**	**$0**	**$0**
3.1.6	Establish Source Criteria	2d		$0	$0	$0	0%	20%	$0	$0	$0
3.1.7 -- Receive Proposals											
				$0	**$0**	**$0**			**$0**	**$0**	**$0**
3.1.7	Receive Proposals	20d		$0	$0	$0	0%	20%	$0	$0	$0
3.1.8 -- Source Selection and Award											
				$0	**$0**	**$0**			**$0**	**$0**	**$0**
3.1.8	Source Selection and Award	10d		$0	$0	$0	0%	20%	$0	$0	$0
3.2 -- Title 3 EDIA C Sector High Voltage											
				$0	**$150,018**	**$150,018**			**$30,003**	**$0**	**$180,022**
				$0	**$150,018**	**$150,018**			**$30,003**	**$0**	**$180,022**

BTeV - WBS 3.0 C0 Building Outfitting

Total Construction Costs

Fermilab Labor: Salary, OPTO, Vacation, Fringe & Overhead

Non-Fermilab Labor: Salary, Benefits & Overhead

No Escalation, No Full material Procurement 'Burdening'

Activity ID	Activity Description	Duration	Labor and Material & Services Resource Information	Material & Services Cost	Labor Cost	Base Budget	Labor Contingency (%)	Materials & Services Contingency (%)	Labor Contingency ($)	Materials & Services Contingency ($)	Total Budget (Base + Contingency)
3.2	Title 3 EDIA C Sector High Voltage	158d	BTEV.FNAL.FESS.EE,1780	$0	$150,018	$150,018	20%	0%	$30,003	$0	$180,022
3.3 -- C Sector high voltage Const. Contract											
				$537,189	**$0**	**$537,189**			**$0**	**$107,437**	**$644,626**
3.3.1 -- Notice to Proceed											
				$0	**$0**	**$0**			**$0**	**$0**	**$0**
3.3.1	Notice to Proceed	1d		$0	$0	$0	0%	20%	$0	$0	$0
3.3.2 -- Mobolize											
				$0	**$0**	**$0**			**$0**	**$0**	**$0**
3.3.2	Mobolize	15d		$0	$0	$0	0%	0%	$0	$0	$0
3.3.3 -- KRS to B-4											
				$295,534	**$0**	**$295,534**			**$0**	**$59,106**	**$354,641**
3.3.3.1	Install Switch in KRS	3d	BTEV.FNAL.MANDS.BASE,32977	$38,253	$0	$38,253	0%	20%	$0	$7,650	$45,903
3.3.3.2	Pull Cable KRS to E2	10d	BTEV.FNAL.MANDS.BASE,32977	$38,253	$0	$38,253	0%	20%	$0	$7,650	$45,903
3.3.3.3	Pull Cable E2 to E-0	5d	BTEV.FNAL.MANDS.BASE,32977	$38,253	$0	$38,253	0%	20%	$0	$7,650	$45,903
3.3.3.4	Pull Cable E-0 to C-2	4d	BTEV.FNAL.MANDS.BASE,32977	$38,253	$0	$38,253	0%	20%	$0	$7,650	$45,903
3.3.3.5	Pull Cable C-2 to C-0	3d	BTEV.FNAL.MANDS.BASE,20477	$23,753	$0	$23,753	0%	20%	$0	$4,750	$28,503
3.3.3.6	Pull Cable C-0 to B-4	2d	BTEV.FNAL.MANDS.BASE,20477	$23,753	$0	$23,753	0%	20%	$0	$4,750	$28,503
3.3.3.7	Fire wrap E-2, E-0, D-2	14d	BTEV.FNAL.MANDS.BASE,20477	$23,753	$0	$23,753	0%	20%	$0	$4,750	$28,503
3.3.3.8	Fire wrap C-4, C-2, B-4	12d	BTEV.FNAL.MANDS.BASE,20477	$23,753	$0	$23,753	0%	20%	$0	$4,750	$28,503
3.3.3.9	Terminate in 4 way switch	2d	BTEV.FNAL.MANDS.BASE,20477	$23,753	$0	$23,753	0%	20%	$0	$4,750	$28,503
3.3.3.10	Splice to Feeder 49	2d	BTEV.FNAL.MANDS.BASE,10239	$11,877	$0	$11,877	0%	20%	$0	$2,375	$14,252
3.3.3.11	Test Cables	2d	BTEV.FNAL.MANDS.BASE,10239	$11,877	$0	$11,877	0%	20%	$0	$2,375	$14,252
3.3.4 -- IR Primary Power											
				$241,654	**$0**	**$241,654**			**$0**	**$48,330**	**$289,985**
3.3.4.1	Install Duct Bank B-4	10d	BTEV.FNAL.MANDS.BASE,38032	$44,117	$0	$44,117	0%	20%	$0	$8,823	$52,940
3.3.4.2	Install Duct Bank C-0	10d	BTEV.FNAL.MANDS.BASE,57418	$66,604	$0	$66,604	0%	20%	$0	$13,320	$79,925
3.3.4.3	Install Duct Bank C-1	10d	BTEV.FNAL.MANDS.BASE,30551	$35,439	$0	$35,439	0%	20%	$0	$7,087	$42,526
3.3.4.4	Install Transformer Pad B-4	5d	BTEV.FNAL.MANDS.BASE,9878	$11,458	$0	$11,458	0%	20%	$0	$2,291	$13,750
3.3.4.5	Install Transformer Pad C-0	14d	BTEV.FNAL.MANDS.BASE,27166	$31,512	$0	$31,512	0%	20%	$0	$6,302	$37,815
3.3.4.6	Install Transformer Pad C-1	5d	BTEV.FNAL.MANDS.BASE,9878	$11,458	$0	$11,458	0%	20%	$0	$2,291	$13,750
3.3.4.7	Install Transformer B-4	4d	BTEV.FNAL.MANDS.BASE,6000	$6,960	$0	$6,960	0%	20%	$0	$1,392	$8,352
3.3.4.8	Install Transformer C-0	4d	BTEV.FNAL.MANDS.BASE,12000	$13,920	$0	$13,920	0%	20%	$0	$2,784	$16,704
3.3.4.9	Install Transformer C-1	4d	BTEV.FNAL.MANDS.BASE,6000	$6,960	$0	$6,960	0%	20%	$0	$1,392	$8,352
3.3.4.10	Install Panel boards	20d	BTEV.FNAL.MANDS.BASE,11400	$13,224	$0	$13,224	0%	20%	$0	$2,644	$15,868
3.3.4.11	Pull 13.8 KV Primary, splice and wrap B-4	7d		$0	$0	$0	0%	20%	$0	$0	$0
3.3.4.12	Pull 13.8 KV Primary, splice and wrap C-0	7d		$0	$0	$0	0%	20%	$0	$0	$0
3.3.4.13	Pull 13.8 KV Primary, splice and wrap C-1	7d		$0	$0	$0	0%	20%	$0	$0	$0
3.3.4.14	Pull and terminate secondary	5d		$0	$0	$0	0%	20%	$0	$0	$0
3.3.4.15	Clean Transformers	3d		$0	$0	$0	0%	20%	$0	$0	$0

BTeV - WBS 3.0 C0 Building Outfitting

Total Construction Costs

Fermilab Labor: Salary, OPTO, Vacation, Fringe & Overhead

Non-Fermilab Labor: Salary, Benefits & Overhead

No Escalation, No Full material Procurement 'Burdening'

Activity ID	Activity Description	Duration	Labor and Material & Services Resource Information	Material & Services Cost	Labor Cost	Base Budget	Labor Contingency (%)	Materials & Services Contingency (%)	Labor Contingency ($)	Materials & Services Contingency ($)	Total Budget (Base + Contingency)
3.3.4.16	Testing	3d		$0	$0	$0	0%	20%	$0	$0	$0
3.3.4.17	Punch List	10d		$0	$0	$0	0%	20%	$0	$0	$0
3.3.4.18	C Sector H V Complete	1d		$0	$0	$0	0%	0%	$0	$0	$0
4 -- Pre Procured Items											
				$625,337	$38,347	$663,684			$7,669	$125,067	$796,421
4.1 -- Procure Item EDIA FESS											
				$0	$38,347	$38,347			$7,669	$0	$46,016
				$0	$38,347	$38,347			$7,669	$0	$46,016
4.1	Procure Item EDIA FESS	21d	BTEV.FNAL.FESS.EE,455	$0	$38,347	$38,347	20%	0%	$7,669	$0	$46,016
4.2 -- Write procured item specs											
				$0	$0	$0			$0	$0	$0
				$0	$0	$0			$0	$0	$0
4.2	Write procured item specs	30d		$0	$0	$0	0%	18%	$0	$0	$0
4.3 -- Bid and award cable											
				$0	$0	$0			$0	$0	$0
				$0	$0	$0			$0	$0	$0
4.3	Bid and award cable	42d		$0	$0	$0	0%	18%	$0	$0	$0
4.4 -- Phase 1 Cable Procure and delivery											
				$16,441	$0	$16,441			$0	$3,288	$19,730
				$16,441	$0	$16,441			$0	$3,288	$19,730
4.4	Phase 1 Cable Procure and delivery	119d	BTEV.FNAL.MANDS.BASE,14174	$16,441	$0	$16,441	0%	20%	$0	$3,288	$19,730
4.5 -- C Sector Cable procure and delivery											
				$246,617	$0	$246,617			$0	$49,323	$295,940
				$246,617	$0	$246,617			$0	$49,323	$295,940
4.5	C Sector Cable procure and delivery	119d	BTEV.FNAL.MANDS.BASE,212601	$246,617	$0	$246,617	0%	20%	$0	$49,323	$295,940
4.6 -- Bid and award transformers											
				$0	$0	$0			$0	$0	$0
				$0	$0	$0			$0	$0	$0
4.6	Bid and award transformers	42d		$0	$0	$0	0%	20%	$0	$0	$0
4.7 -- Phase 1 Transformer Procure and Deliver											
				$61,480	$0	$61,480			$0	$12,296	$73,776
				$61,480	$0	$61,480			$0	$12,296	$73,776
4.7	Phase 1 Transformer Procure and Deliver	105d	BTEV.FNAL.MANDS.BASE,53000	$61,480	$0	$61,480	0%	20%	$0	$12,296	$73,776
4.8 -- C SectorTrans. procure and delivery											
				$242,440	$0	$242,440			$0	$48,488	$290,928

BTeV - WBS 3.0 C0 Building Outfitting

Total Construction Costs

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Non-Fermilab Labor: Salary, Benefits & Overhead

No Escalation, No Full material Procurement 'Burdening'

Activity ID	Activity Description	Duration	Labor and Material & Services Resource Information	Material & Services Cost	Labor Cost	Base Budget	Labor Contingency (%)	Materials & Services Contingency (%)	Labor Contingency ($)	Materials & Services Contingency ($)	Total Budget (Base + Contingency)
				$242,440	$0	$242,440			$0	$48,488	$290,928
4.8	C SectorTrans. procure and delivery	105d	BTEV.FNAL.MANDS.BASE,209000	$242,440	$0	$242,440	0%	20%	$0	$48,488	$290,928
4.9 -- Bid and award Air switch											
				$0	$0	$0			$0	$0	$0
				$0	$0	$0			$0	$0	$0
4.9	Bid and award Air switch	42d		$0	$0	$0	0%	20%	$0	$0	$0
4.10 -- Phase 1 4-Bay Switch Procure and Delivery											
				$29,179	$0	$29,179			$0	$5,835	$35,015
				$29,179	$0	$29,179			$0	$5,835	$35,015
4.10	Phase 1 4-Bay Switch Procure and Delivery	75d	BTEV.FNAL.MANDS.BASE,25155	$29,179	$0	$29,179	0%	20%	$0	$5,835	$35,015
4.11 -- C Sector 4-Bay Switch procure and delivery											
				$29,178	$0	$29,178			$0	$5,835	$35,014
				$29,178	$0	$29,178			$0	$5,835	$35,014
4.11	C Sector 4-Bay Switch procure and delivery	75d	BTEV.FNAL.MANDS.BASE,25154	$29,178	$0	$29,178	0%	20%	$0	$5,835	$35,014
5 -- Milestones											
				$0	$0	$0			$0	$0	$0
5.1 -- Lev2Mil: MS-1 Start Engineering											
				$0	$0	$0			$0	$0	$0
				$0	$0	$0			$0	$0	$0
5.1	Lev2Mil: MS-1 Start Engineering	0		$0	$0	$0	0%	0%	$0	$0	$0
5.2 -- Lev1Mil: MS-2 Start Construction											
				$0	$0	$0			$0	$0	$0
				$0	$0	$0			$0	$0	$0
5.2	Lev1Mil: MS-2 Start Construction	0		$0	$0	$0	0%	0%	$0	$0	$0
5.3 -- Lev3Mil: MS-3 Side Bay. Struct. Complete											
				$0	$0	$0			$0	$0	$0
				$0	$0	$0			$0	$0	$0
5.3	Lev3Mil: MS-3 Side Bay. Struct. Complete	0		$0	$0	$0	0%	0%	$0	$0	$0
5.4 -- Lev3Mil: MS-4 Temo Power Operational (Fdr 45)											
				$0	$0	$0			$0	$0	$0
				$0	$0	$0			$0	$0	$0
5.4	Lev3Mil: MS-4 Temo Power Operational (Fdr 45)	0		$0	$0	$0	0%	0%	$0	$0	$0
5.5 -- Lev1Mil: MS-5 Beneficial occupancy of lower level and upper staging area											
				$0	$0	$0			$0	$0	$0
				$0	$0	$0			$0	$0	$0

BTeV - WBS 3.0 C0 Building Outfitting

Total Construction Costs

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Non-Fermilab Labor: Salary, Benefits & Overhead

No Escalation, No Full material Procurement 'Burdening'

Activity ID	Activity Description	Duration	Labor and Material & Services Resource Information	Material & Services Cost	Labor Cost	Base Budget	Labor Contingency (%)	Materials & Services Contingency (%)	Labor Contingency ($)	Materials & Services Contingency ($)	Total Budget (Base + Contingency)
5.5	Lev1Mil: MS-5 Beneficial occupancy of lower level and upper staging area	0		$0	$0	$0	0%	0%	$0	$0	$0
5.6 -- Lev1Mil: MS-6 Collision Hall Complete											
				$0	$0	$0			$0	$0	$0
				$0	$0	$0			$0	$0	$0
5.6	Lev1Mil: MS-6 Collision Hall Complete	0		$0	$0	$0	0%	0%	$0	$0	$0
5.7 -- Lev3Mil: MS-7 Mechancal Systems Complete (Except CH)											
				$0	$0	$0			$0	$0	$0
				$0	$0	$0			$0	$0	$0
5.7	Lev3Mil: MS-7 Mechancal Systems Complete (Except CH)	0		$0	$0	$0	0%	0%	$0	$0	$0
5.8 -- Lev3Mil: MS-8 Electrical Systems Complete											
				$0	$0	$0			$0	$0	$0
				$0	$0	$0			$0	$0	$0
5.8	Lev3Mil: MS-8 Electrical Systems Complete	0		$0	$0	$0	0%	0%	$0	$0	$0
5.9 -- Lev1Mil: MS-9 Assembly, Service Building Construction Complete											
				$0	$0	$0			$0	$0	$0
				$0	$0	$0			$0	$0	$0
5.9	Lev1Mil: MS-9 Assembly, Service Building Construction Complete	0		$0	$0	$0	0%	0%	$0	$0	$0
5.10 -- Lev2Mil: MS-10 Engineering Complete											
				$0	$0	$0			$0	$0	$0
				$0	$0	$0			$0	$0	$0
5.10	Lev2Mil: MS-10 Engineering Complete	0		$0	$0	$0	0%	0%	$0	$0	$0
5.12 -- Level 1 & Inter-Subproject Link Milestones											
				$0	$0	$0			$0	$0	$0
5.12.2 -- Construction Phase Milestones											
				$0	$0	$0			$0	$0	$0
5.12.2.1	Lnk1Mil: Start Construction Phase	0		$0	$0	$0	0%	0%	$0	$0	$0
5.12.2.2	Lnk1Mil: Begin FY05 Shutdown	0		$0	$0	$0	0%	0%	$0	$0	$0
5.12.2.3	Lnk1Mil: End FY05 Shutdown	0		$0	$0	$0	0%	0%	$0	$0	$0
5.12.2.4	Lnk1Mil: Begin FY06	0		$0	$0	$0	0%	0%	$0	$0	$0
5.12.2.5	Lnk1 Mil: Begin FY06 Shutdown	0		$0	$0	$0	0%	0%	$0	$0	$0
5.12.2.6	Lnk1Mil: End FY06 Shutdown	0		$0	$0	$0	0%	0%	$0	$0	$0
5.12.2.7	Lnk1Mil: Start FY07	0		$0	$0	$0	0%	0%	$0	$0	$0
5.12.2.8	Lnk1Mil: Begin FY07 Shutdown	0		$0	$0	$0	0%	0%	$0	$0	$0
5.12.2.9	Lnk1Mil: End FY07 Shutdown	0		$0	$0	$0	0%	0%	$0	$0	$0

BTeV - WBS 3.0 C0 Building Outfitting

Total Construction Cost Profile ($K) by Institution & Fiscal Year

Fermilab Labor: Salary, OPTO, Vacation, Fringe & Overhead

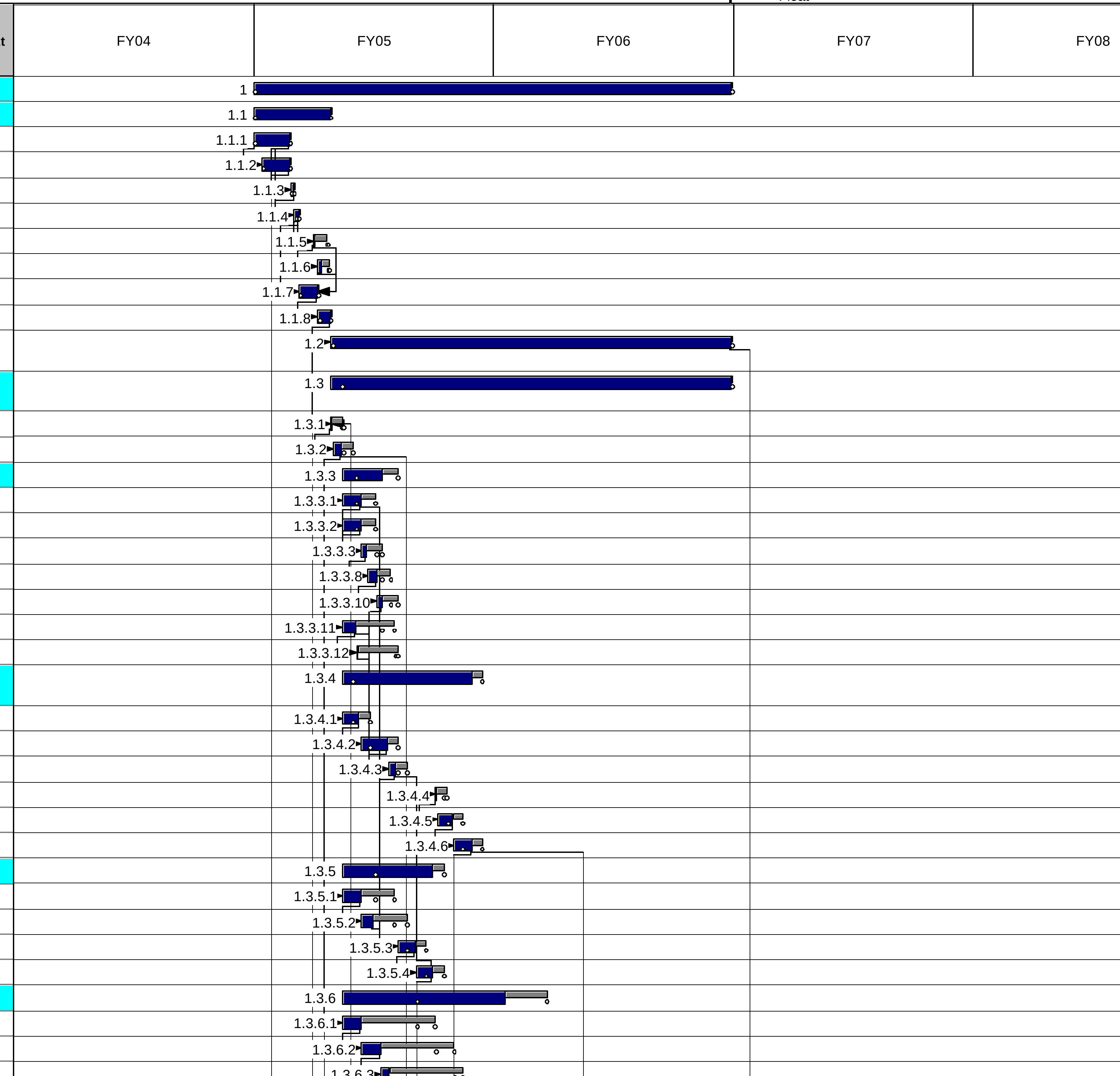
Non-Fermilab Labor: Salary, Benefits & Overhead

No Contingency, No Escalation, No Full material Procurement 'Burdening'

12Apr04

Planned
Critical
Late Dates
Milestone
Progress
Summary
Float

Activity ID	Activity Description	Materials & Services Costs	Labor Costs	Total Cost	Early Start	Early Finish	Float
1	C-0 Outfitting Phase 1	$1,812,958	$426,288	$2,239,246	01Oct04	28Sep06	1d
1.1	Design to Award C-0 Phase 1	$66,515	$166,537	$233,052	01Oct04	27Jan05	1d
1.1.1	Title II EDIA FESS Phase 1	$0	$166,537	$166,537	01Oct04	25Nov04	1d
1.1.2	Title II EDIA Consultant Phase 1	$66,515	$0	$66,515	15Oct04	25Nov04	1d
1.1.3	Construction Req.	$0	$0	$0	26Nov04	02Dec04	1d
1.1.4	Release for Bid	$0	$0	$0	03Dec04	09Dec04	1d
1.1.5	Pre-Bid Meeting	$0	$0	$0	31Dec04	31Dec04	15d
1.1.6	Establish Source Criteria	$0	$0	$0	07Jan05	11Jan05	11d
1.1.7	Receive Proposals	$0	$0	$0	10Dec04	06Jan05	1d
1.1.8	Source Selection& Award	$0	$0	$0	07Jan05	27Jan05	1d
1.2	Title 3 EDIA C-0 Outfitting Phase 1	$0	$259,750	$259,750	28Jan05	28Sep06	1d
1.3	C-0 Outfitting Phase 1 Construction Contract	$1,746,442	$0	$1,746,442	28Jan05	28Sep06	1d
1.3.1	Notice to Proceed	$0	$0	$0	28Jan05	28Jan05	11d
1.3.2	Mobilize	$18,580	$0	$18,580	31Jan05	11Feb05	11d
1.3.3	Site Concrete	$30,423	$0	$30,423	14Feb05	15Apr05	16d
1.3.3.1	S & A Concrete Mix	$0	$0	$0	14Feb05	14Mar05	16d
1.3.3.2	S & A Rebar	$0	$0	$0	14Feb05	14Mar05	16d
1.3.3.3	FBP Foundations at Stair	$7,047	$0	$7,047	15Mar05	23Mar05	16d
1.3.3.8	Construct Hardstands	$14,227	$0	$14,227	24Mar05	06Apr05	16d
1.3.3.10	Site Utilities	$5,568	$0	$5,568	07Apr05	15Apr05	16d
1.3.3.11	Rework Temp Power	$0	$0	$0	14Feb05	04Mar05	43d
1.3.3.12	Demo Int. Stair Enclosure	$3,580	$0	$3,580	07Mar05	09Mar05	43d
1.3.4	Structural Steel & Weather Enclosures	$241,956	$0	$241,956	14Feb05	29Aug05	11d
1.3.4.1	S & A Steel Shop Drawings	$0	$0	$0	14Feb05	11Mar05	11d
1.3.4.2	Fab and ship Steel	$0	$0	$0	14Mar05	22Apr05	11d
1.3.4.3	Erect Structural Steel	$65,774	$0	$65,774	25Apr05	06May05	11d
1.3.4.4	Install Steel Stairs and misc.	$42,019	$0	$42,019	04Jul05	07Jul05	11d
1.3.4.5	Siding & Roofing	$65,050	$0	$65,050	08Jul05	01Aug05	11d
1.3.4.6	Electronics Bridge	$69,111	$0	$69,111	02Aug05	29Aug05	11d
1.3.5	Structural Concrete	$108,566	$0	$108,566	14Feb05	01Jul05	11d
1.3.5.1	S & A Rebar and Tendons.	$0	$0	$0	14Feb05	14Mar05	36d
1.3.5.2	Fab Rebar and Tendons	$0	$0	$0	15Mar05	01Apr05	36d
1.3.5.3	FBP Concrete @ El. 744'	$54,283	$0	$54,283	09May05	03Jun05	11d
1.3.5.4	FBP Concrete @ El 764'	$54,283	$0	$54,283	06Jun05	01Jul05	11d
1.3.6	Concrete Masonry	$151,057	$0	$151,057	14Feb05	18Oct05	11d
1.3.6.1	S & A Masonry SD	$0	$0	$0	14Feb05	14Mar05	81d
1.3.6.2	S & A Doors and Glass	$0	$0	$0	15Mar05	12Apr05	81d
1.3.6.3	Concrete Masonry El 715-0	$11,113	$0	$11,113	13Apr05	25Apr05	81d



BTeV - WBS 3.0 C0 Building Outfitting

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12Apr04

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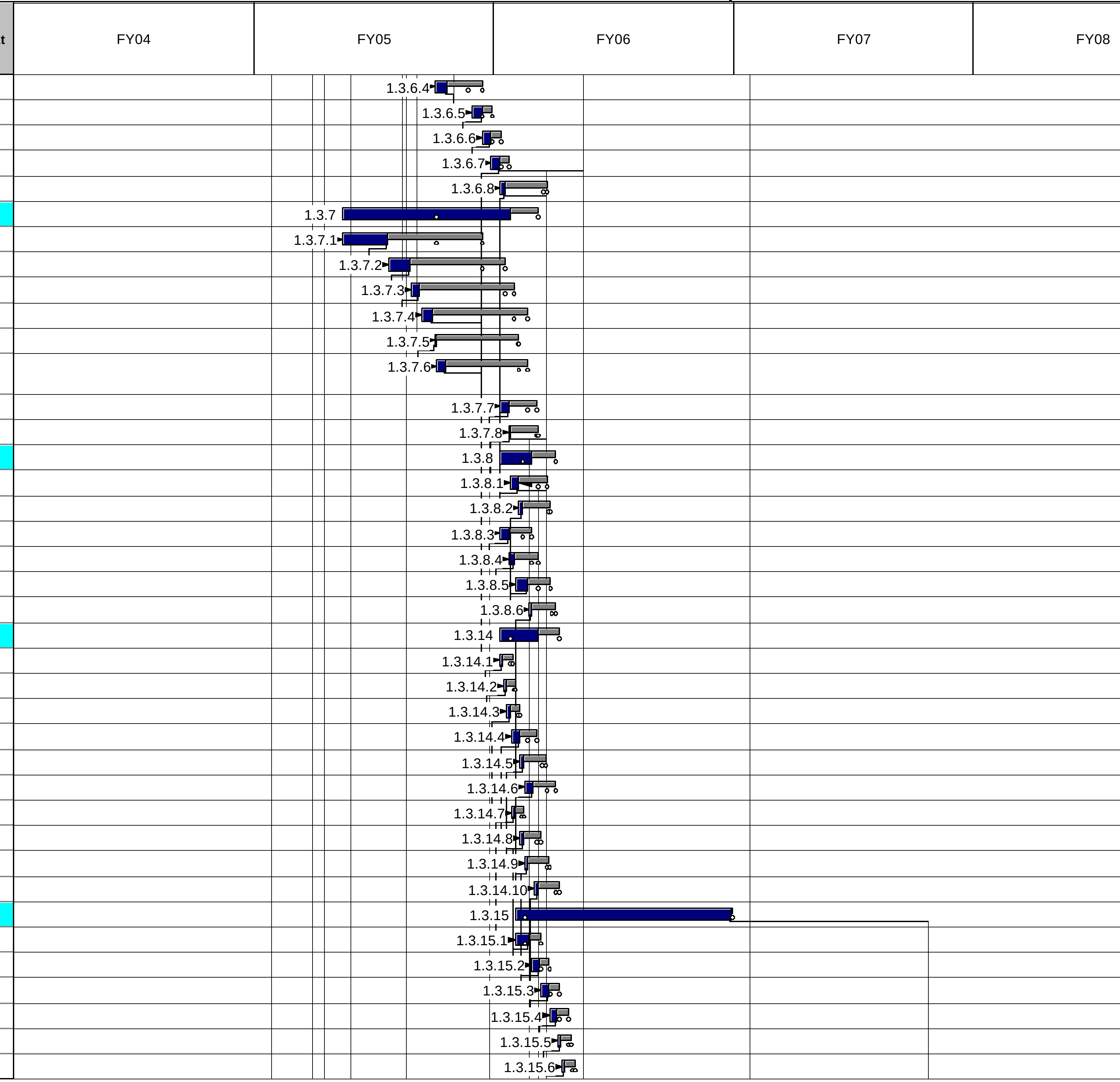
Activity ID	Activity Description	Materials & Services Costs	Labor Costs	Total Cost	Early Start	Early Finish	Float
1.3.6.4	Concrete Masonry El 731'-4	$16,670	$0	$16,670	04Jul05	22Jul05	37d
1.3.6.5	Concrete Masonry El 746-6	$27,784	$0	$27,784	30Aug05	14Sep05	11d
1.3.6.6	Concrete Masonry El 755-4	$27,784	$0	$27,784	15Sep05	27Sep05	11d
1.3.6.7	Concrete Masonry El 766-0	$27,784	$0	$27,784	28Sep05	10Oct05	11d
1.3.6.8	Install Doors and Glass	$39,920	$0	$39,920	11Oct05	18Oct05	47d
1.3.7	Conveying System	$152,488	$0	$152,488	14Feb05	26Oct05	31d
1.3.7.1	S & A Elevator SD	$0	$0	$0	14Feb05	22Apr05	102d
1.3.7.2	Fab and Del elev Rails	$0	$0	$0	25Apr05	27May05	102d
1.3.7.3	Install elev rails	$28,400	$0	$28,400	30May05	10Jun05	102d
1.3.7.4	Install Elevator Machine Rm	$56,801	$0	$56,801	13Jun05	01Jul05	102d
1.3.7.5	Demo Roof	$1,185	$0	$1,185	04Jul05	05Jul05	90d
1.3.7.6	Frame, Side & Roof Elevator Head house	$9,301	$0	$9,301	06Jul05	19Jul05	90d
1.3.7.7	Install Elevator Cab	$56,801	$0	$56,801	11Oct05	24Oct05	31d
1.3.7.8	Energize and Test Elevator	$0	$0	$0	25Oct05	26Oct05	31d
1.3.8	Finishes	$76,724	$0	$76,724	11Oct05	29Nov05	25d
1.3.8.1	Paint Block Walls	$18,769	$0	$18,769	27Oct05	09Nov05	31d
1.3.8.2	Paint Doors & Glass Frames	$10,959	$0	$10,959	10Nov05	15Nov05	31d
1.3.8.3	Rough In Toilet Rm Plumbing	$23,498	$0	$23,498	11Oct05	24Oct05	25d
1.3.8.4	Toilet RM Walls	$0	$0	$0	25Oct05	02Nov05	25d
1.3.8.5	Toilet Rm Finishes	$0	$0	$0	03Nov05	23Nov05	25d
1.3.8.6	Trim out Toilet Rm. Fixtures	$23,498	$0	$23,498	24Nov05	29Nov05	25d
1.3.14	Fire Protection	$170,870	$0	$170,870	11Oct05	07Dec05	11d
1.3.14.1	Install Fire Riser to High Bay	$17,087	$0	$17,087	11Oct05	14Oct05	11d
1.3.14.2	Install Fire Riser to Side bay	$17,087	$0	$17,087	17Oct05	20Oct05	11d
1.3.14.3	Rough In Sprinklers El 731'-4"	$17,087	$0	$17,087	21Oct05	27Oct05	11d
1.3.14.4	Rough In sprinklers El 746'-6	$17,087	$0	$17,087	28Oct05	10Nov05	18d
1.3.14.5	Rough In Sprinklers El.755'-4	$17,087	$0	$17,087	11Nov05	17Nov05	23d
1.3.14.6	Rough In Sprinklers El 766'-0	$17,087	$0	$17,087	18Nov05	01Dec05	23d
1.3.14.7	Trim Out Sprinklers El 731'-4"	$17,087	$0	$17,087	28Oct05	02Nov05	11d
1.3.14.8	Trim Out sprinklers El 746'-6	$17,087	$0	$17,087	11Nov05	16Nov05	18d
1.3.14.9	Trim Out Sprinklers El.755'-4	$17,087	$0	$17,087	18Nov05	23Nov05	23d
1.3.14.10	Trim Out Sprinklers El 766'-0	$17,087	$0	$17,087	02Dec05	07Dec05	23d
1.3.15	Fire Detection	$98,783	$0	$98,783	03Nov05	28Sep06	1d
1.3.15.1	Fire Detection El 731'-4"	$9,878	$0	$9,878	03Nov05	25Nov05	11d
1.3.15.2	Fire Detection El 746'-6	$19,757	$0	$19,757	28Nov05	09Dec05	11d
1.3.15.3	Fire Detection El.755'-4	$19,757	$0	$19,757	12Dec05	23Dec05	11d
1.3.15.4	Fire Detection El 766'-0	$19,757	$0	$19,757	26Dec05	06Jan06	11d
1.3.15.5	Upgrade Fire Control Panel	$9,878	$0	$9,878	09Jan06	12Jan06	11d
1.3.15.6	Test All Fire Detection	$9,878	$0	$9,878	13Jan06	17Jan06	11d



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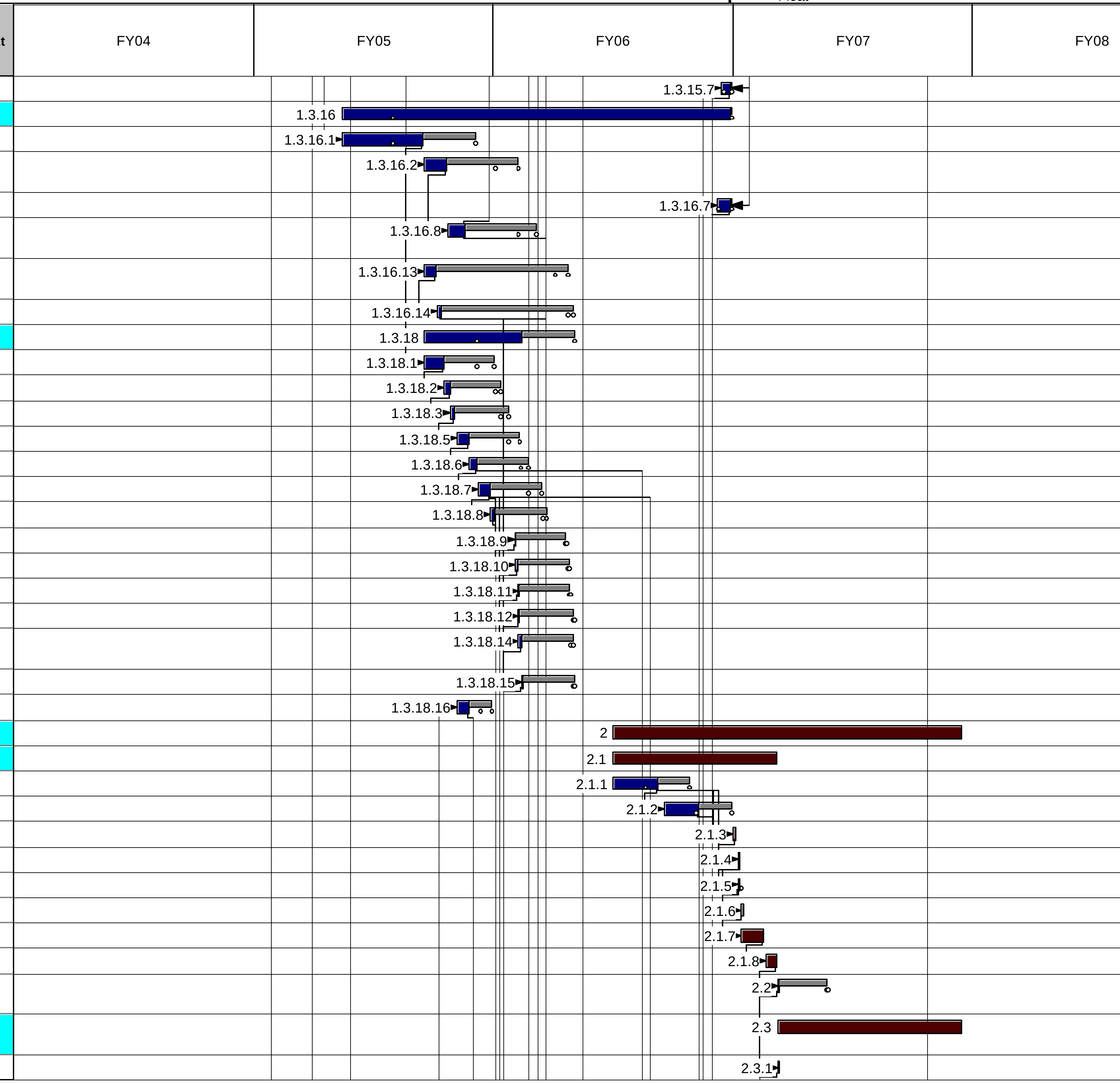
1.3.15.7	Fire Detection Collision Hall	$9,878	$0	$9,878	15Sep06	28Sep06	1d
1.3.16	Power Distribution and Lighting	$262,715	$0	$262,715	14Feb05	28Sep06	1d
1.3.16.1	S & A Electrical Devices	$0	$0	$0	14Feb05	17Jun05	56d
1.3.16.2	Rough In House Power El 715'-0	$80,659	$0	$80,659	20Jun05	22Jul05	77d
1.3.16.7	Coll Hall Power	$91,439	$0	$91,439	08Sep06	28Sep06	1d
1.3.16.8	Trim Out House Power El 715'-0	$80,659	$0	$80,659	25Jul05	19Aug05	77d
1.3.16.13	Install Exist. 2000 Amp Switchbd	$9,958	$0	$9,958	20Jun05	07Jul05	142d
1.3.16.14	Pull and terminate secondary	$0	$0	$0	08Jul05	15Jul05	142d
1.3.18	Feeder From B-4 to C-0	$434,278	$0	$434,278	20Jun05	15Nov05	25d
1.3.18.1	Concrete and Rebar SD	$0	$0	$0	20Jun05	18Jul05	56d
1.3.18.2	Install Duct bank B-4 to Berm	$42,838	$0	$42,838	19Jul05	27Jul05	56d
1.3.18.3	Jack Carrier pipe thru berm	$21,420	$0	$21,420	28Jul05	05Aug05	56d
1.3.18.5	Install duct bank MH to C-0 Pad	$42,838	$0	$42,838	08Aug05	25Aug05	56d
1.3.18.6	Install secondary duct bank	$149,908	$0	$149,908	26Aug05	07Sep05	56d
1.3.18.7	Install Pad, C-0 Test Area	$53,652	$0	$53,652	08Sep05	27Sep05	56d
1.3.18.8	Install switch Pad at B-4	$0	$0	$0	28Sep05	04Oct05	56d
1.3.18.9	Set switch at B-4	$2,400	$0	$2,400	03Nov05	03Nov05	56d
1.3.18.10	Set Transformers C-0	$25,200	$0	$25,200	04Nov05	08Nov05	56d
1.3.18.11	Set Switch C-0 Test	$2,400	$0	$2,400	09Nov05	09Nov05	56d
1.3.18.12	Set Generator C-0 Test	$75,531	$0	$75,531	10Nov05	10Nov05	58d
1.3.18.14	Pull Feeder B-4 to C-0 Test Area	$0	$0	$0	10Nov05	14Nov05	56d
1.3.18.15	Terminate Primary	$0	$0	$0	15Nov05	15Nov05	56d
1.3.18.16	Rerack Main Ring Manholes	$18,091	$0	$18,091	08Aug05	26Aug05	25d
2	C-0 Outfitting Phase 2	$1,859,031	$444,071	$2,303,102	03Apr06	14Sep07	0
2.1	Design to Award C-0 Phase 2	$46,400	$187,185	$233,585	03Apr06	08Dec06	0
2.1.1	Title II EDIA FESS	$0	$187,185	$187,185	03Apr06	09Jun06	35d
2.1.2	Title II EDIA Consultant	$46,400	$0	$46,400	19Jun06	11Aug06	35d
2.1.3	Construction Req.	$0	$0	$0	02Oct06	06Oct06	0
2.1.4	Release for Bid	$0	$0	$0	09Oct06	13Oct06	0
2.1.5	Pre- Bid Meeting	$0	$0	$0	09Oct06	09Oct06	4d
2.1.6	Establish Source Criteria	$0	$0	$0	16Oct06	18Oct06	0
2.1.7	Receive Proposals	$0	$0	$0	16Oct06	17Nov06	0
2.1.8	Source Selection& Award	$0	$0	$0	20Nov06	08Dec06	0
2.2	Title 3 EDIA C-0 Outfitting Phase 2	$0	$256,885	$256,885	11Dec06	11Dec06	53d
2.3	C-0 Outfitting Phase 2 Construction Contract	$1,812,631	$0	$1,812,631	11Dec06	14Sep07	0
2.3.1	Notice to Proceed	$0	$0	$0	11Dec06	11Dec06	0



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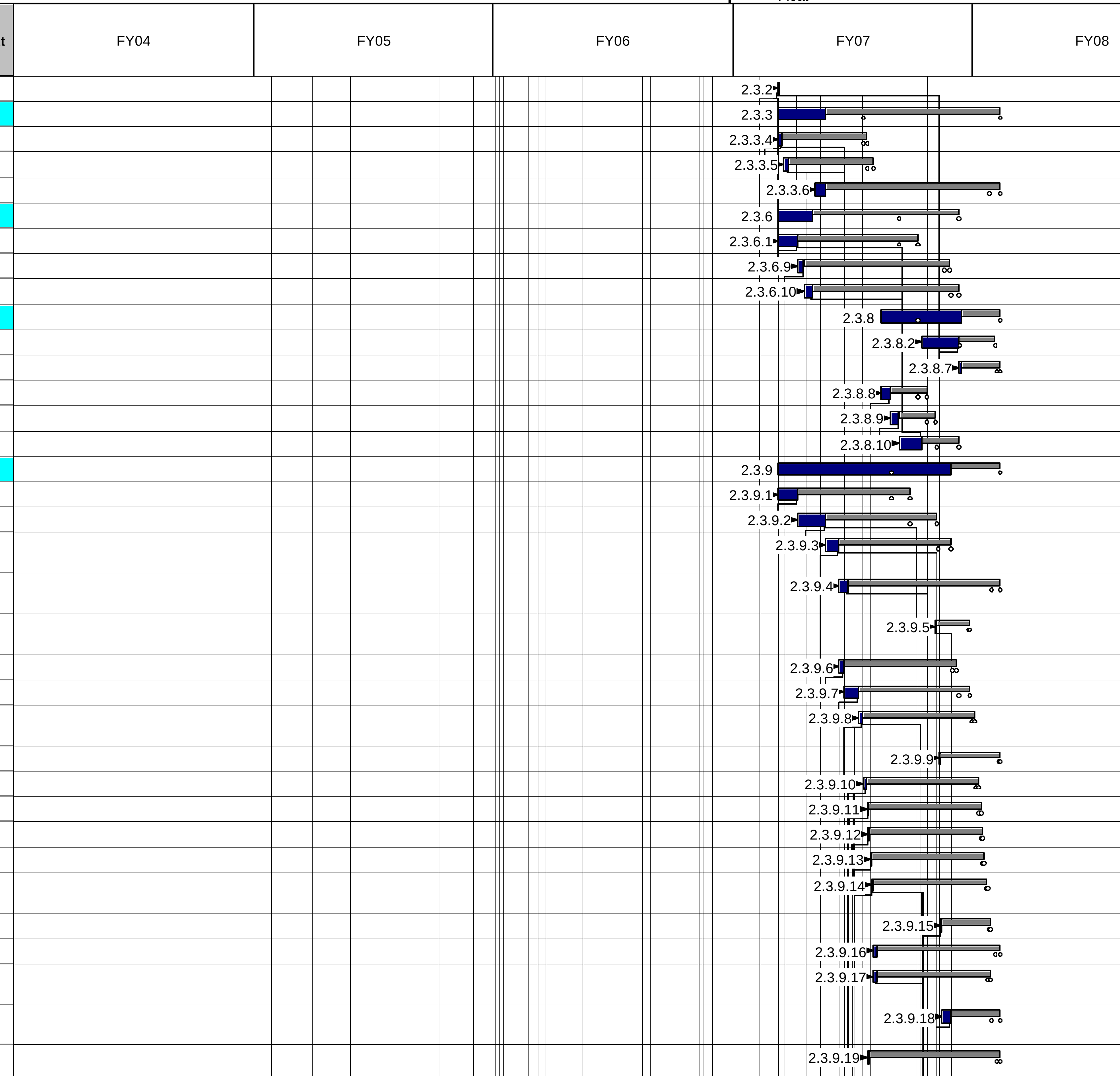
2.3.2	Mobilize	$0	$0	$0	11Dec06	11Dec06	0
2.3.3	Site Concrete	$114,016	$0	$114,016	11Dec06	20Feb07	92d
2.3.3.4	FBP Chiller Pads	$34,376	$0	$34,376	11Dec06	15Dec06	92d
2.3.3.5	FBP Condenser Pads	$51,565	$0	$51,565	18Dec06	26Dec06	92d
2.3.3.6	Construct Gas House	$28,074	$0	$28,074	05Feb07	20Feb07	189d
2.3.6	Masonry	$50,689	$0	$50,689	11Dec06	31Jan07	131d
2.3.6.1	S & A Finishes	$0	$0	$0	11Dec06	08Jan07	131d
2.3.6.9	C-0 Service Bldg. Mods	$11,728	$0	$11,728	09Jan07	17Jan07	159d
2.3.6.10	C-0 SB Buss Duct Enclosure	$38,960	$0	$38,960	18Jan07	31Jan07	159d
2.3.8	Finishes	$221,492	$0	$221,492	15May07	14Sep07	41d
2.3.8.2	Fab and Deliver Finishes	$0	$0	$0	17Jul07	10Sep07	41d
2.3.8.7	Flooring & Carpeting El 755'-4	$16,536	$0	$16,536	11Sep07	14Sep07	41d
2.3.8.8	Install Computer Floor El 746'-6	$72,842	$0	$72,842	15May07	28May07	41d
2.3.8.9	Install Computer Floor El. 766'-0	$72,842	$0	$72,842	29May07	11Jun07	41d
2.3.8.10	C-0 Service Bldg. Mods	$59,271	$0	$59,271	12Jun07	16Jul07	41d
2.3.9	HVAC System	$475,946	$0	$475,946	11Dec06	30Aug07	37d
2.3.9.1	S & A HVAC Units	$0	$0	$0	11Dec06	08Jan07	123d
2.3.9.2	F & D HVAC Units	$0	$0	$0	09Jan07	19Feb07	123d
2.3.9.3	Install HVAC Units Coll. Hall & Assem Hall	$80,212	$0	$80,212	20Feb07	12Mar07	123d
2.3.9.4	Install HVAC Units + Off & MUA	$34,913	$0	$34,913	13Mar07	26Mar07	165d
2.3.9.5	Collision Hall work, (Duct, fancoil, Piping	$37,241	$0	$37,241	06Aug07	08Aug07	37d
2.3.9.6	Duct Work	$77,068	$0	$77,068	13Mar07	20Mar07	123d
2.3.9.7	Install Ductwk El 755'-4"	$11,458	$0	$11,458	21Mar07	10Apr07	123d
2.3.9.8	Install Motorized Dampers and Louvers	$14,323	$0	$14,323	11Apr07	17Apr07	123d
2.3.9.9	Comm. and Training HVAC	$18,522	$0	$18,522	13Aug07	13Aug07	65d
2.3.9.10	Insulate Ductwork	$37,044	$0	$37,044	18Apr07	23Apr07	123d
2.3.9.11	Install Toilet Room Exhaust	$3,704	$0	$3,704	24Apr07	25Apr07	123d
2.3.9.12	Install Mech Rom Exhaust	$6,174	$0	$6,174	26Apr07	27Apr07	123d
2.3.9.13	Install DCW pipe and Humidifier	$14,818	$0	$14,818	30Apr07	01May07	123d
2.3.9.14	Balance HVAC System, Assy, Of & MUA	$5,704	$0	$5,704	02May07	03May07	123d
2.3.9.15	Balance HVAC Sys. Col Hall	$2,444	$0	$2,444	15Aug07	16Aug07	52d
2.3.9.16	Install Sensors and Controls	$58,344	$0	$58,344	04May07	10May07	132d
2.3.9.17	Start Up and Comm (Non Shutdowwn Related)	$19,244	$0	$19,244	04May07	09May07	123d
2.3.9.18	Start Up and Comm (Shutdown Related)	$19,244	$0	$19,244	17Aug07	30Aug07	52d
2.3.9.19	Install Bridge HVAC Unit Piping and Startup	$12,348	$0	$12,348	24Apr07	27Apr07	141d



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2.3.9.20	Install CRAC Condensing Unit AC for El 746	$16,719	$0	$16,719	29May07	05Jun07	100d
2.3.9.21	Install Ref Piping Test, Fill and Charge Ins and Startup	$6,419	$0	$6,419	06Jun07	11Jun07	100d
2.3.10	Chilled Water System (CHW)	$281,095	$0	$281,095	11Dec06	21Aug07	59d
2.3.10.1	S & A Chillers, W/ Controls	$0	$0	$0	11Dec06	08Jan07	59d
2.3.10.2	F & D Chillers W/ Controls	$0	$0	$0	09Jan07	19Mar07	59d
2.3.10.3	S & A Chilled Water Pumps	$0	$0	$0	20Mar07	17Apr07	59d
2.3.10.4	F & D Chilled Water Pumps	$0	$0	$0	18Apr07	06Jun07	59d
2.3.10.5	Install Chillers	$110,416	$0	$110,416	18Apr07	20Apr07	97d
2.3.10.6	Install Chilled Water Pumps	$4,229	$0	$4,229	07Jun07	13Jun07	59d
2.3.10.7	Install CHW piping supports and Fittings	$43,909	$0	$43,909	14Jun07	27Jun07	59d
2.3.10.8	Install Tanks and Othere Hydronic items	$11,082	$0	$11,082	28Jun07	11Jul07	59d
2.3.10.9	Install ECW pipe header on 756 Comp Rm.	$17,100	$0	$17,100	12Jul07	19Jul07	59d
2.3.10.10	Leak test and Insulate ECW Header	$5,700	$0	$5,700	20Jul07	25Jul07	59d
2.3.10.11	Leak test & Insulate CHW	$9,567	$0	$9,567	26Jul07	02Aug07	59d
2.3.10.12	Install Sensors and Controls	$49,593	$0	$49,593	03Aug07	10Aug07	59d
2.3.10.13	Flush tag and Fill System	$3,704	$0	$3,704	13Aug07	13Aug07	59d
2.3.10.14	Startup & Bal CHW	$3,257	$0	$3,257	14Aug07	14Aug07	59d
2.3.10.15	Comm and Training	$22,538	$0	$22,538	15Aug07	21Aug07	59d
2.3.11	High Density Computer Cooling	$235,183	$0	$235,183	11Dec06	10Apr07	44d
2.3.11.1	S & A Computer Rm. Air Handlers	$0	$0	$0	11Dec06	08Jan07	53d
2.3.11.2	F & D Computer Room Air handlers	$0	$0	$0	09Jan07	19Feb07	53d
2.3.11.3	Install Comp. Rm Condensers pad mnt.	$81,497	$0	$81,497	20Feb07	07Mar07	53d
2.3.11.4	Install Comp room Air handlers El; 766	$93,143	$0	$93,143	20Feb07	07Mar07	53d
2.3.11.5	Ref. Piping CRAC	$14,818	$0	$14,818	20Feb07	01Mar07	57d
2.3.11.6	Leak Test and Charge Ref Piping	$3,754	$0	$3,754	08Mar07	13Mar07	53d
2.3.11.7	Install DCW & Humidifier	$11,113	$0	$11,113	14Mar07	15Mar07	53d
2.3.11.8	Insulate and Tag Piping	$14,510	$0	$14,510	16Mar07	20Mar07	53d
2.3.11.9	Install Controls	$12,965	$0	$12,965	03Apr07	06Apr07	44d
2.3.11.10	Startup Balance Comm and Training	$3,383	$0	$3,383	09Apr07	10Apr07	44d
2.3.12	746'-6 Computer Room Cooling	$0	$0	$0	11Dec06	05Jun07	113d
2.3.12.1	S & A Computer Room Heat Exchanger	$0	$0	$0	11Dec06	08Jan07	143d
2.3.12.2	F & D HeatExger + 8 Pumps	$0	$0	$0	09Jan07	19Feb07	143d

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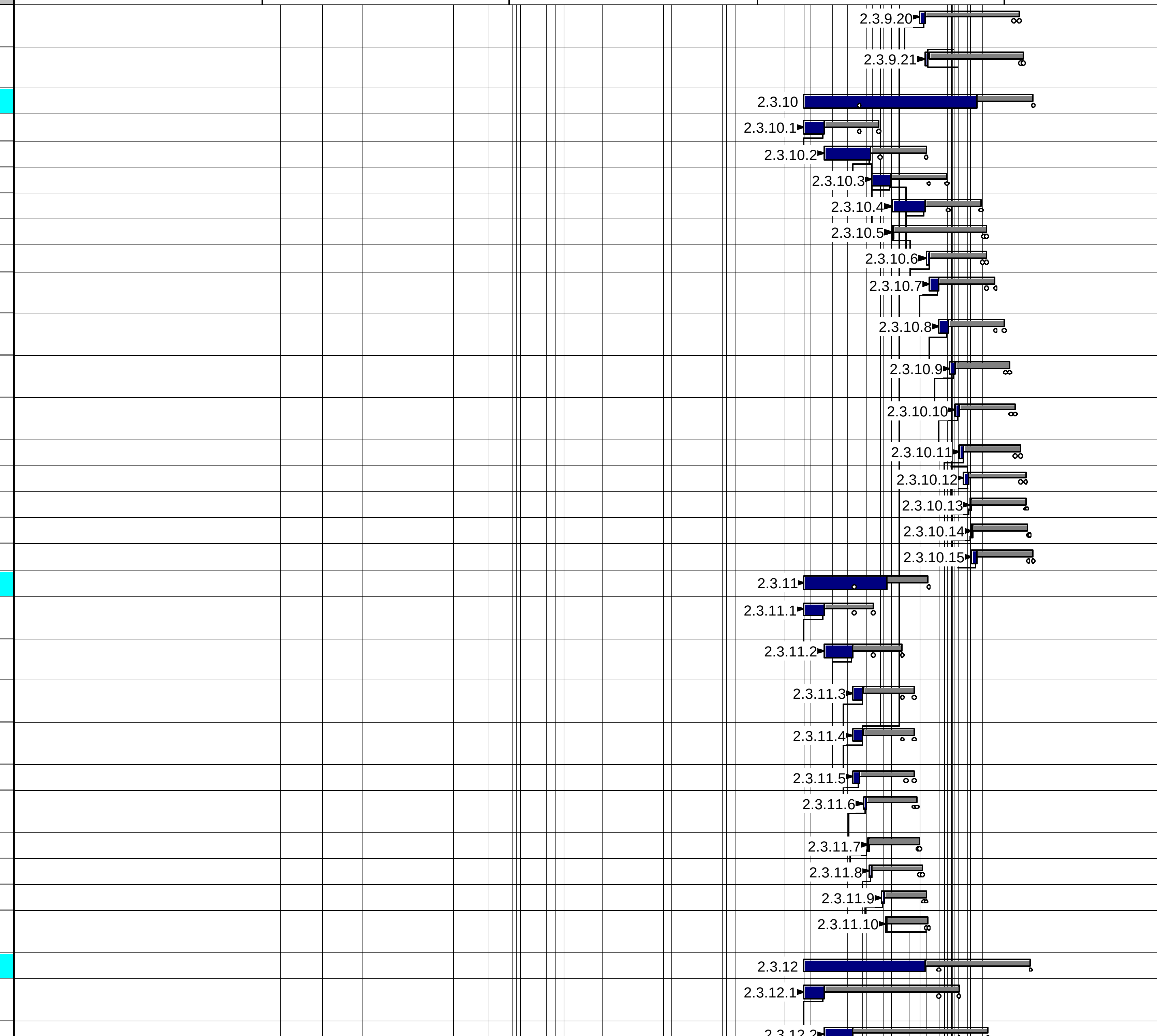

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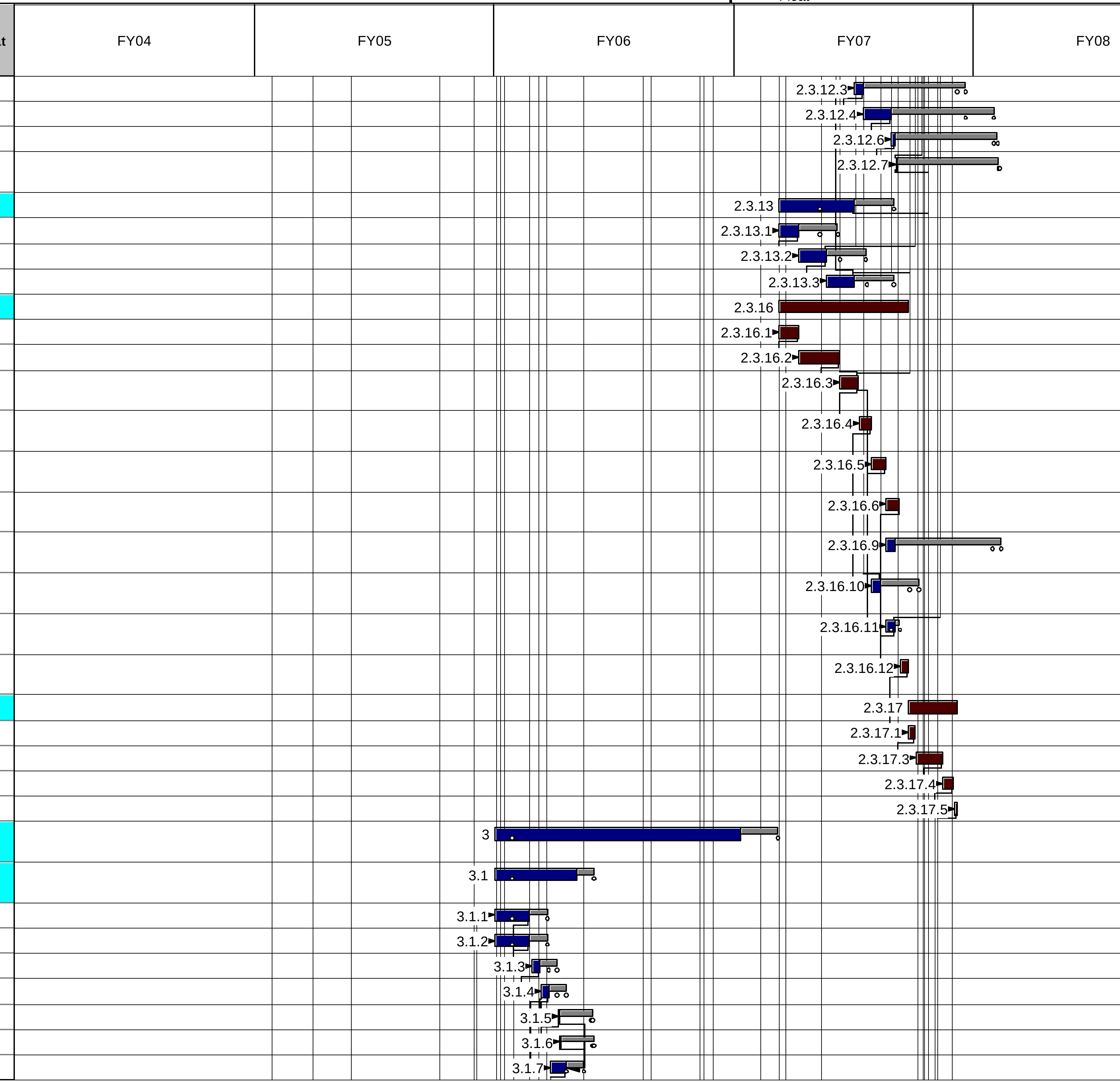
2.3.12.3	Install HeatExger	$0	$0	$0	03Apr07	16Apr07	113d
2.3.12.4	Install Piping El 746'-6 System	$0	$0	$0	17Apr07	28May07	113d
2.3.12.6	Test and Balance El 746	$0	$0	$0	29May07	04Jun07	113d
2.3.12.7	Commissioning and Training El 746	$0	$0	$0	05Jun07	05Jun07	113d
2.3.13	Motor Control Center (MCC)	$32,863	$0	$32,863	11Dec06	02Apr07	44d
2.3.13.1	S & A MCC	$0	$0	$0	11Dec06	08Jan07	44d
2.3.13.2	F & D Motor Control Center	$0	$0	$0	09Jan07	19Feb07	44d
2.3.13.3	Install Motor Control Center	$32,863	$0	$32,863	20Feb07	02Apr07	44d
2.3.16	Power Distribution and Lighting	$217,270	$0	$217,270	11Dec06	25Jun07	0
2.3.16.1	S & A Material Submittals	$0	$0	$0	11Dec06	08Jan07	0
2.3.16.2	Fab and Del.	$0	$0	$0	09Jan07	12Mar07	0
2.3.16.3	Rough In Power & Lighting El 731	$45,322	$0	$45,322	13Mar07	09Apr07	0
2.3.16.4	Rough In Power & Lighting El 746'-6	$11,114	$0	$11,114	10Apr07	30Apr07	0
2.3.16.5	Rough In Power & Lighting El. 755'-4	$24,977	$0	$24,977	01May07	21May07	0
2.3.16.6	Rough In Power & Lighting El 766'-0	$27,222	$0	$27,222	22May07	11Jun07	0
2.3.16.9	Trim Out House Power El 731'-0	$45,322	$0	$45,322	22May07	04Jun07	115d
2.3.16.10	Trim Out Power & Lighting El 746'-6	$11,114	$0	$11,114	01May07	14May07	41d
2.3.16.11	Trim Out Power & Lighting El. 755'-4	$24,977	$0	$24,977	22May07	04Jun07	5d
2.3.16.12	Trim Out Power & Lighting El 766'-0	$27,222	$0	$27,222	12Jun07	25Jun07	0
2.3.17	Side Bay Computer Power	$184,075	$0	$184,075	26Jun07	07Sep07	0
2.3.17.1	Install User Panels El 746'-6	$73,474	$0	$73,474	26Jun07	05Jul07	0
2.3.17.3	Install User Panels El. 766'-0	$110,601	$0	$110,601	06Jul07	16Aug07	0
2.3.17.4	Punch List	$0	$0	$0	17Aug07	31Aug07	0
2.3.17.5	Commision Coll. Hall	$0	$0	$0	03Sep07	07Sep07	0
3	C Sector High Voltage Power Upgrade	$599,249	$175,470	$774,720	03Oct05	10Oct06	19d
3.1	Design to Award C Sector High Voltage	$62,060	$25,452	$87,512	03Oct05	03Feb06	19d
3.1.1	Title II EDIA FESS Engineering	$0	$25,452	$25,452	03Oct05	25Nov05	19d
3.1.2	Title II EDIA Consultant Eng.	$62,060	$0	$62,060	03Oct05	25Nov05	19d
3.1.3	Construction Req.	$0	$0	$0	28Nov05	09Dec05	19d
3.1.4	Release for Bid	$0	$0	$0	12Dec05	23Dec05	19d
3.1.5	Pre- Bid Meeting	$0	$0	$0	09Jan06	09Jan06	36d
3.1.6	Establish Source Criteria	$0	$0	$0	10Jan06	11Jan06	36d
3.1.7	Receive Proposals	$0	$0	$0	26Dec05	20Jan06	19d



BTeV - WBS 3.0 C0 Building Outfitting

Total Construction Cost Profile ($K) by Institution & Fiscal Year

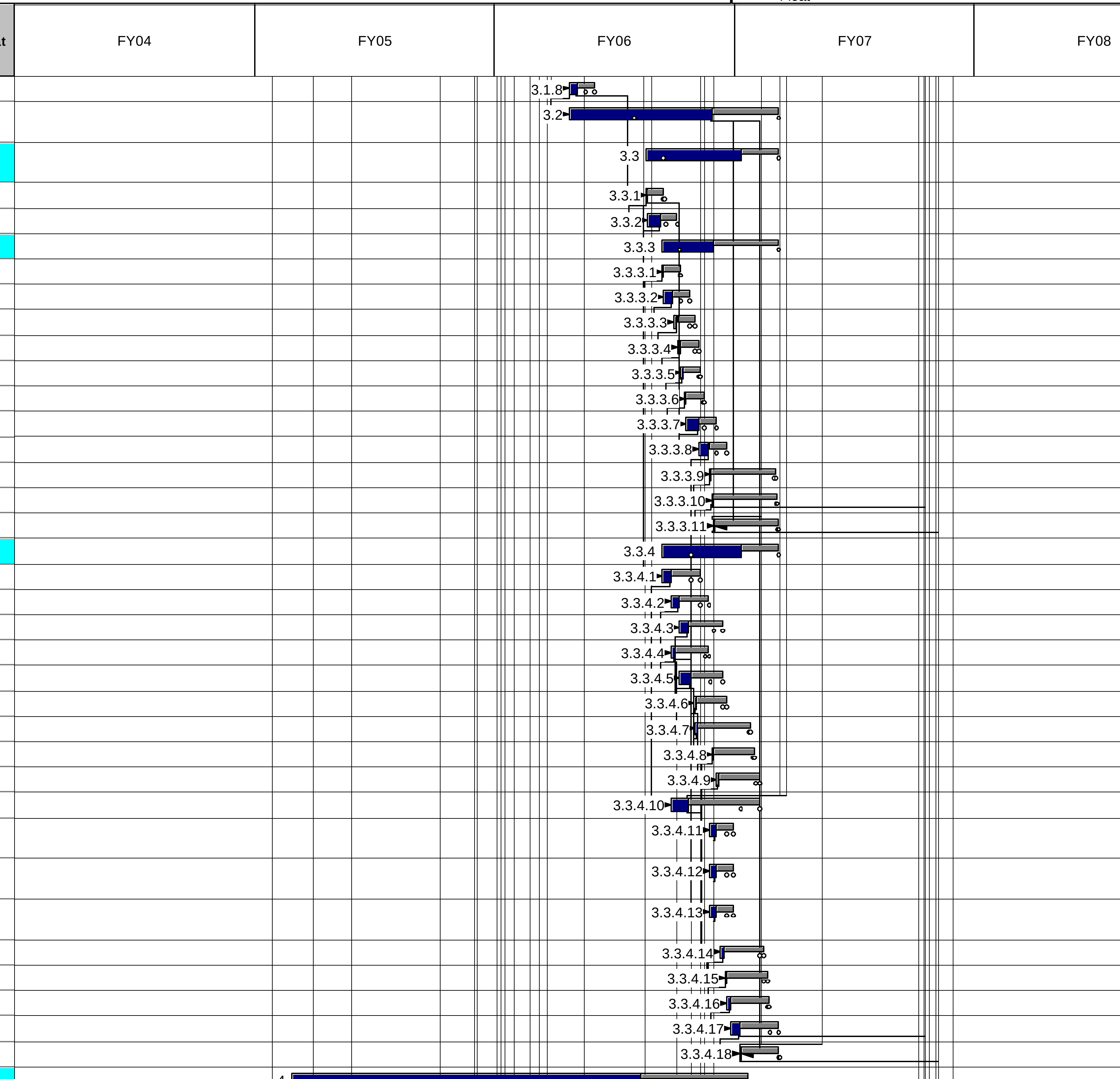
Fermilab Labor: Salary, OPTO, Vacation, Fringe & Overhead

Non-Fermilab Labor: Salary, Benefits & Overhead

No Contingency, No Escalation, No Full material Procurement 'Burdening'

Planned
Critical
Late Dates
Milestone
Progress
Summary
Float

Activity ID	Activity Description	Materials & Services Costs	Labor Costs	Total Cost	Early Start	Early Finish	Float
3.1.8	Source Selection and Award	$0	$0	$0	23Jan06	03Feb06	19d
3.2	Title 3 EDIA C Sector High Voltage	$0	$150,018	$150,018	23Jan06	30Aug06	72d
3.3	C Sector high voltage Const. Contract	$537,189	$0	$537,189	22May06	10Oct06	19d
3.3.1	Notice to Proceed	$0	$0	$0	22May06	22May06	19d
3.3.2	Mobolize	$0	$0	$0	23May06	12Jun06	19d
3.3.3	KRS to B-4	$295,534	$0	$295,534	13Jun06	01Sep06	19d
3.3.3.1	Install Switch in KRS	$38,253	$0	$38,253	13Jun06	15Jun06	19d
3.3.3.2	Pull Cable KRS to E2	$38,253	$0	$38,253	16Jun06	29Jun06	19d
3.3.3.3	Pull Cable E2 to E-0	$38,253	$0	$38,253	30Jun06	06Jul06	19d
3.3.3.4	Pull Cable E-0 to C-2	$38,253	$0	$38,253	07Jul06	12Jul06	19d
3.3.3.5	Pull Cable C-2 to C-0	$23,753	$0	$23,753	13Jul06	17Jul06	19d
3.3.3.6	Pull Cable C-0 to B-4	$23,753	$0	$23,753	18Jul06	19Jul06	19d
3.3.3.7	Fire wrap E-2, E-0, D-2	$23,753	$0	$23,753	20Jul06	08Aug06	19d
3.3.3.8	Fire wrap C-4, C-2, B-4	$23,753	$0	$23,753	09Aug06	24Aug06	19d
3.3.3.9	Terminate in 4 way switch	$23,753	$0	$23,753	25Aug06	28Aug06	70d
3.3.3.10	Splice to Feeder 49	$11,877	$0	$11,877	29Aug06	30Aug06	70d
3.3.3.11	Test Cables	$11,877	$0	$11,877	31Aug06	01Sep06	70d
3.3.4	IR Primary Power	$241,654	$0	$241,654	13Jun06	10Oct06	19d
3.3.4.1	Install Duct Bank B-4	$44,117	$0	$44,117	13Jun06	26Jun06	33d
3.3.4.2	Install Duct Bank C-0	$66,604	$0	$66,604	27Jun06	10Jul06	33d
3.3.4.3	Install Duct Bank C-1	$35,439	$0	$35,439	11Jul06	24Jul06	37d
3.3.4.4	Install Transformer Pad B-4	$11,458	$0	$11,458	27Jun06	03Jul06	38d
3.3.4.5	Install Transformer Pad C-0	$31,512	$0	$31,512	11Jul06	28Jul06	33d
3.3.4.6	Install Transformer Pad C-1	$11,458	$0	$11,458	31Jul06	04Aug06	33d
3.3.4.7	Install Transformer B-4	$6,960	$0	$6,960	02Aug06	07Aug06	59d
3.3.4.8	Install Transformer C-0	$13,920	$0	$13,920	29Aug06	01Sep06	44d
3.3.4.9	Install Transformer C-1	$6,960	$0	$6,960	05Sep06	08Sep06	43d
3.3.4.10	Install Panel boards	$13,224	$0	$13,224	27Jun06	24Jul06	77d
3.3.4.11	Pull 13.8 KV Primary, splice and wrap B-4	$0	$0	$0	25Aug06	04Sep06	19d
3.3.4.12	Pull 13.8 KV Primary, splice and wrap C-0	$0	$0	$0	25Aug06	04Sep06	19d
3.3.4.13	Pull 13.8 KV Primary, splice and wrap C-1	$0	$0	$0	25Aug06	04Sep06	19d
3.3.4.14	Pull and terminate secondary	$0	$0	$0	11Sep06	15Sep06	43d
3.3.4.15	Clean Transformers	$0	$0	$0	18Sep06	20Sep06	43d
3.3.4.16	Testing	$0	$0	$0	21Sep06	25Sep06	43d
3.3.4.17	Punch List	$0	$0	$0	26Sep06	09Oct06	43d
3.3.4.18	C Sector H V Complete	$0	$0	$0	10Oct06	10Oct06	43d
4	Pre Procured Items	$625,337	$38,347	$663,684	26Nov04	11May06	44d



BTeV - WBS 3.0 C0 Building Outfitting

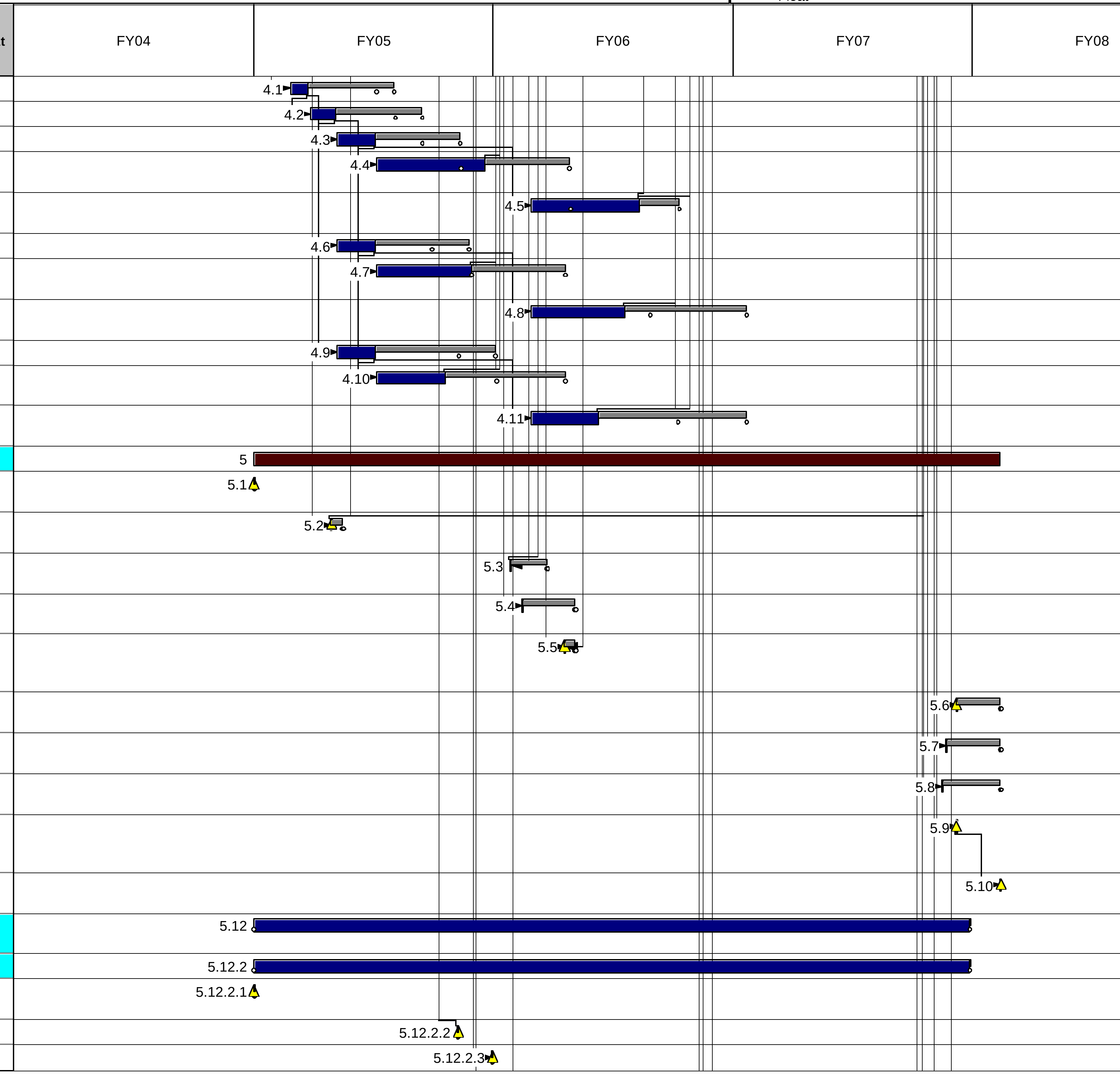
Total Construction Cost Profile ($K) by Institution & Fiscal Year

Fermilab Labor: Salary, OPTO, Vacation, Fringe & Overhead
Non-Fermilab Labor: Salary, Benefits & Overhead
No Contingency, No Escalation, No Full material Procurement 'Burdening'

12Apr04

Planned | Critical | Late Dates | Milestone | Progress | Summary | Float

Activity ID	Activity Description	Materials & Services Costs	Labor Costs	Total Cost	Early Start	Early Finish	Float
4.1	Procure Item EDIA FESS	$0	$38,347	$38,347	26Nov04	24Dec04	93d
4.2	Write procured item specs	$0	$0	$0	27Dec04	04Feb05	93d
4.3	Bid and award cable	$0	$0	$0	07Feb05	05Apr05	93d
4.4	Phase 1 Cable Procure and delivery	$16,441	$0	$16,441	06Apr05	19Sep05	93d
4.5	C Sector Cable procure and delivery	$246,617	$0	$246,617	28Nov05	11May06	44d
4.6	Bid and award transformers	$0	$0	$0	07Feb05	05Apr05	103d
4.7	Phase 1 Transformer Procure and Deliver	$61,480	$0	$61,480	06Apr05	30Aug05	103d
4.8	C SectorTrans. procure and delivery	$242,440	$0	$242,440	28Nov05	21Apr06	131d
4.9	Bid and award Air switch	$0	$0	$0	07Feb05	05Apr05	132d
4.10	Phase 1 4-Bay Switch Procure and Delivery	$29,179	$0	$29,179	06Apr05	19Jul05	132d
4.11	C Sector 4-Bay Switch procure and delivery	$29,178	$0	$29,178	28Nov05	10Mar06	161d
5	Milestones	$0	$0	$0	01Oct04	12Nov07	0
5.1	Lev2Mil: MS-1 Start Engineering	$0	$0	$0	01Oct04	01Oct04	1d
5.2	Lev1Mil: MS-2 Start Construction	$0	$0	$0	28Jan05	28Jan05	12d
5.3	Lev3Mil: MS-3 Side Bay. Struct. Complete	$0	$0	$0	26Oct05	26Oct05	41d
5.4	Lev3Mil: MS-4 Temo Power Operational (Fdr 45)	$0	$0	$0	15Nov05	15Nov05	56d
5.5	Lev1Mil: MS-5 Beneficial occupancy of lower level and upper staging area	$0	$0	$0	17Jan06	17Jan06	11d
5.6	Lev1Mil: MS-6 Collision Hall Complete	$0	$0	$0	07Sep07	07Sep07	46d
5.7	Lev3Mil: MS-7 Mechancal Systems Complete (Except CH)	$0	$0	$0	21Aug07	21Aug07	59d
5.8	Lev3Mil: MS-8 Electrical Systems Complete	$0	$0	$0	16Aug07	16Aug07	62d
5.9	Lev1Mil: MS-9 Assembly, Service Building Construction Complete	$0	$0	$0	07Sep07	07Sep07	0
5.10	Lev2Mil: MS-10 Engineering Complete	$0	$0	$0	12Nov07	12Nov07	0
5.12	Level 1 & Inter-Subproject Link Milestones	$0	$0	$0	01Oct04	28Sep07	1d
5.12.2	Construction Phase Milestones	$0	$0	$0	01Oct04	28Sep07	1d
5.12.2.1	Lnk1Mil: Start Construction Phase	$0	$0	$0	01Oct04	01Oct04	1d
5.12.2.2	Lnk1Mil: Begin FY05 Shutdown	$0	$0	$0	08Aug05	08Aug05	1d
5.12.2.3	Lnk1Mil: End FY05 Shutdown	$0	$0	$0	30Sep05	30Sep05	1d



BTeV - WBS 3.0 C0 Building Outfitting

Total Construction Cost Profile ($K) by Institution & Fiscal Year

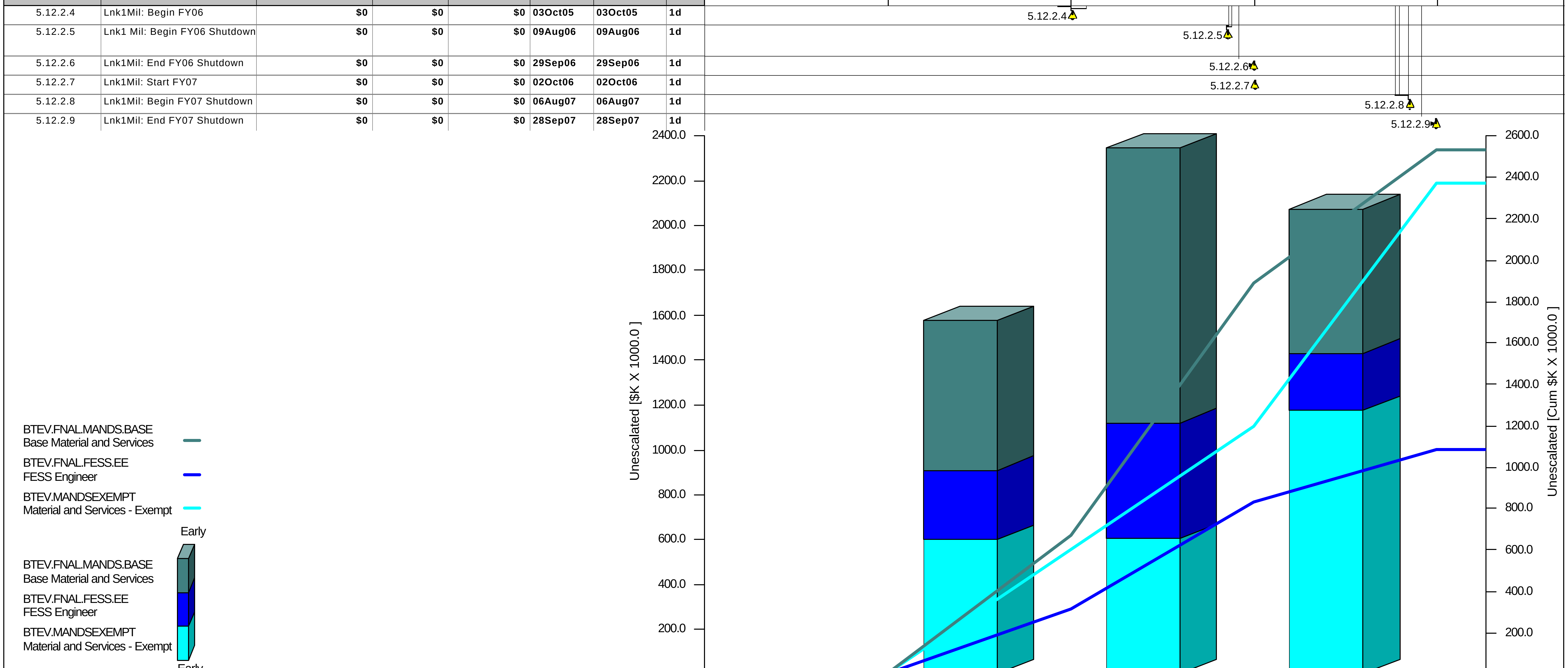
Fermilab Labor: Salary, OPTO, Vacation, Fringe & Overhead

Non-Fermilab Labor: Salary, Benefits & Overhead

No Contingency, No Escalation, No Full material Procurement 'Burdening'

Planned
Critical
Late Dates
Milestone
Progress
Summary
Float

Activity ID	Activity Description	Materials & Services Costs	Labor Costs	Total Cost	Early Start	Early Finish	Float
5.12.2.4	Lnk1Mil: Begin FY06	$0	$0	$0	03Oct05	03Oct05	1d
5.12.2.5	Lnk1 Mil: Begin FY06 Shutdown	$0	$0	$0	09Aug06	09Aug06	1d
5.12.2.6	Lnk1Mil: End FY06 Shutdown	$0	$0	$0	29Sep06	29Sep06	1d
5.12.2.7	Lnk1Mil: Start FY07	$0	$0	$0	02Oct06	02Oct06	1d
5.12.2.8	Lnk1Mil: Begin FY07 Shutdown	$0	$0	$0	06Aug07	06Aug07	1d
5.12.2.9	Lnk1Mil: End FY07 Shutdown	$0	$0	$0	28Sep07	28Sep07	1d



	FY04	FY05	FY06	FY07
BTEV.MANDSEXEMPT : Material and Services - Exempt	0.0	595.7	600.1	1171.2
BTEV.FNAL.FESS.EE : FESS Engineer	0.0	310.0	517.3	256.9
BTEV.FNAL.MANDS.BASE : Base Material and Services	0.0	665.8	1222.3	641.4
BTEV.MANDSEXEMPT : Material and Services - Exempt [Cum]	0.0	595.7	1195.9	2367.1
BTEV.FNAL.FESS.EE : FESS Engineer [Cum]	0.0	310.0	827.3	1084.2
BTEV.FNAL.MANDS.BASE : Base Material and Services [Cum]	0.0	665.8	1888.1	2529.5

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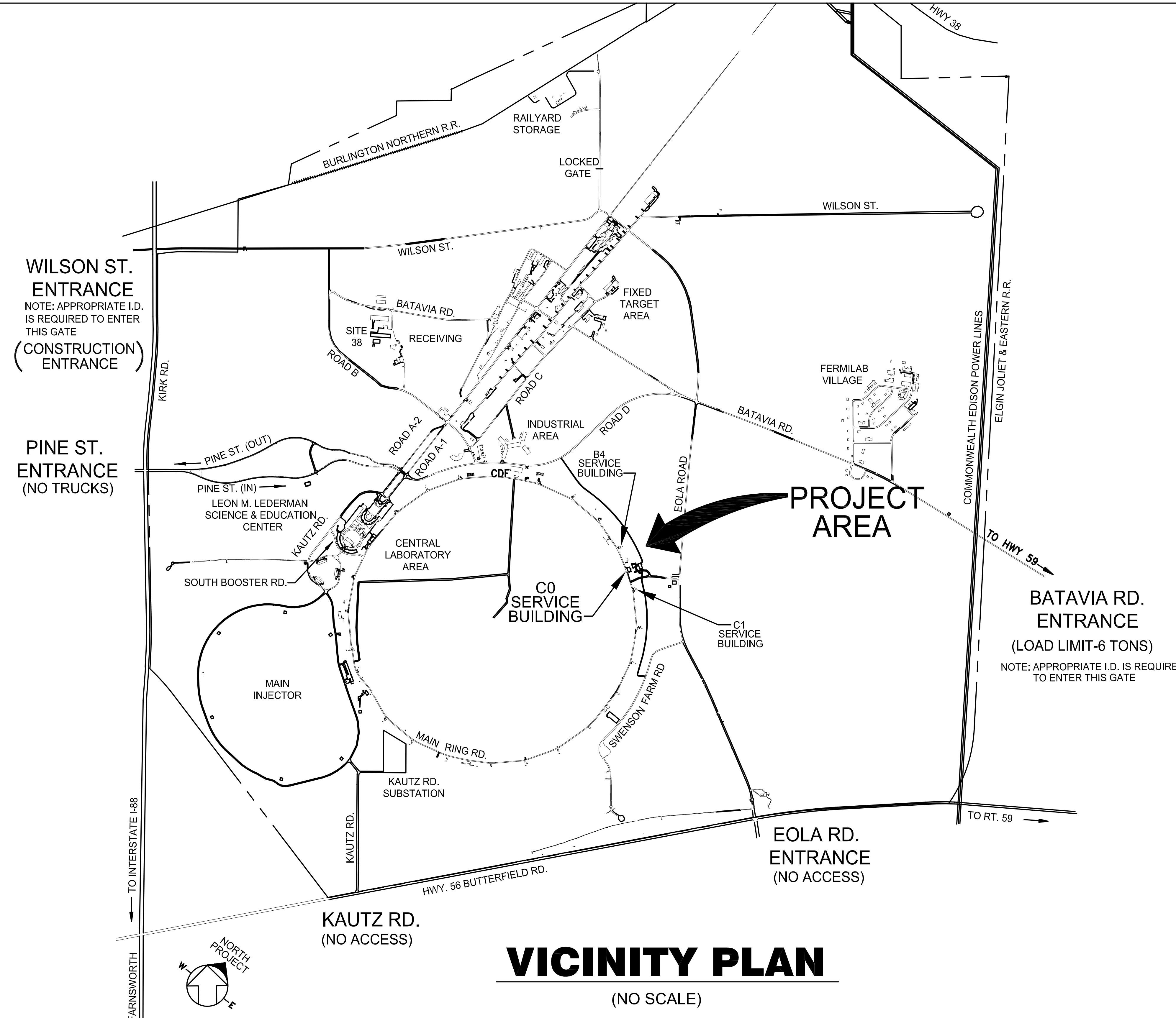

VICINITY PLAN

(NO SCALE)

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
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CHECKED		
APPROVED		
SUBMITTED		

SCALE:

FERMI NATIONAL ACCELERATOR LABORATORY

UNITED STATES DEPARTMENT OF ENERGY

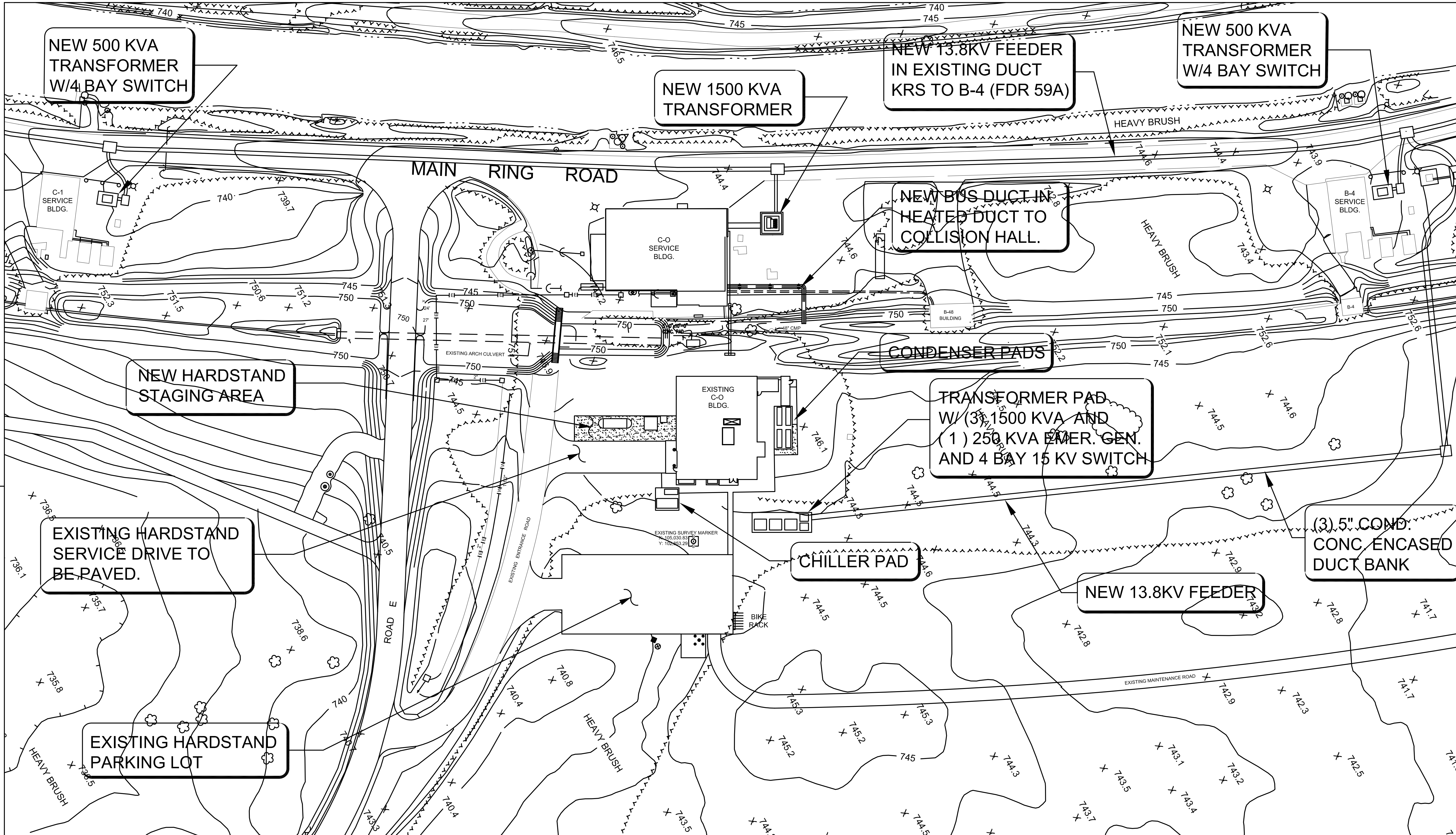
C-0 OUTFITTING

VICINITY PLAN

DRAWING NO. **6-8-3** **CD-1 REVIEW** **C-1** REV.

APRIL 2004

Dwg: C1-C2-C3-6-8-B-TeV.dwg Plotted: 17OCT03 @ 06:54:15a.m.



REV.	DATE	DESCRIPTIONS

REVISIONS

	NAME	DATE
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APPROVED		
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SCALE: 1" = 70'-0"

70 0 70 140
SCALE FEET

PROJECT NORTH

FERMI NATIONAL ACCELERATOR LABORATORY

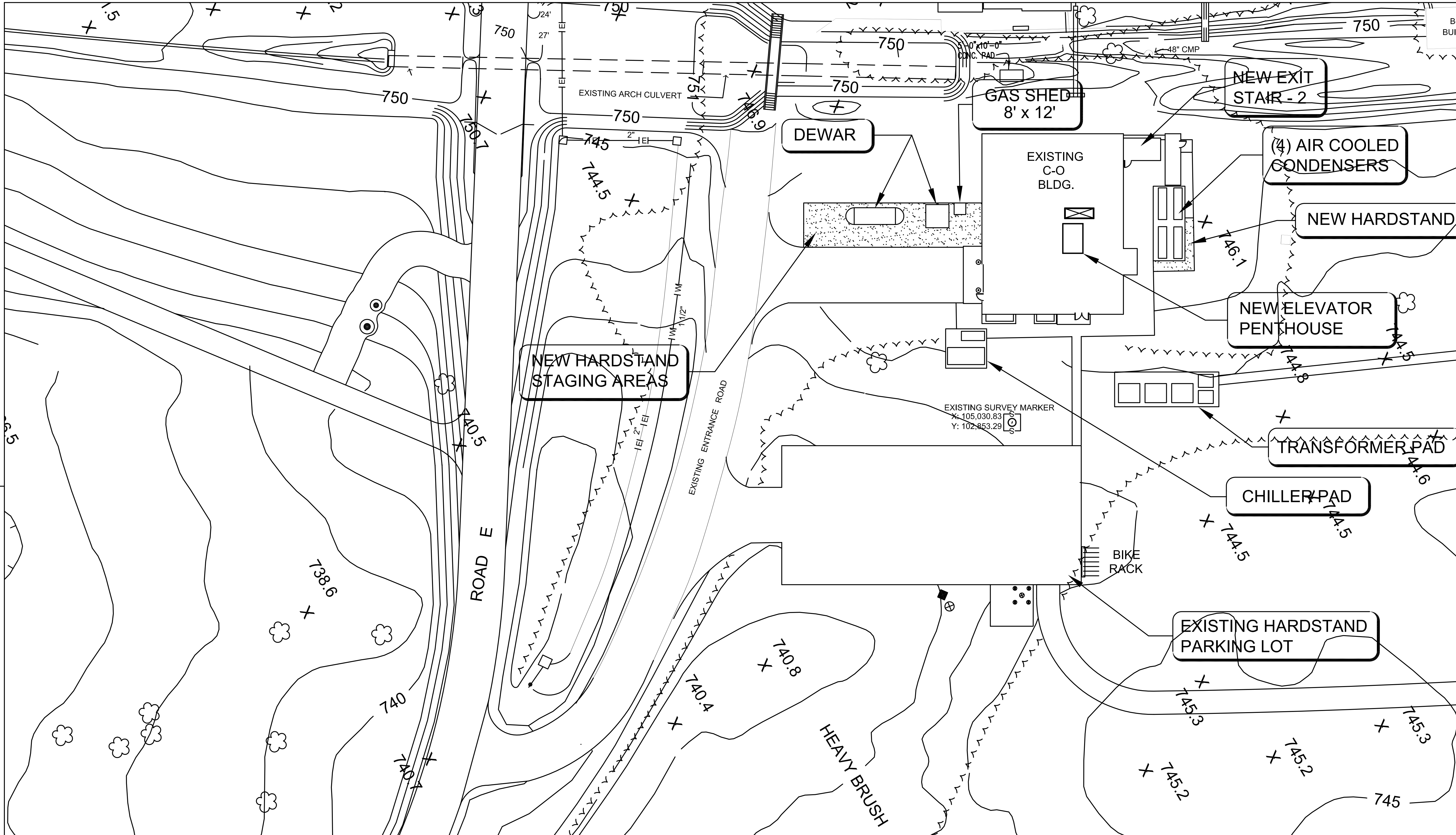
UNITED STATES DEPARTMENT OF ENERGY

C-0 OUTFITTING

SITE PLAN

DRAWING NO. **6-8-3** **CD-1 REVIEW** **C-2** REV.

APRIL 2004



REV.	DATE	DESCRIPTIONS

REVISIONS

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SCALE: 1" = 40'-0"

40 0 40 80 SCALE FEET

PROJECT NORTH

FERMI NATIONAL ACCELERATOR LABORATORY

UNITED STATES DEPARTMENT OF ENERGY

C-0 OUTFITTING

ENLARGED SITE PLAN

DRAWING NO. **6-8-3** **CD-1 REVIEW** **C-3** REV.

APRIL 2004

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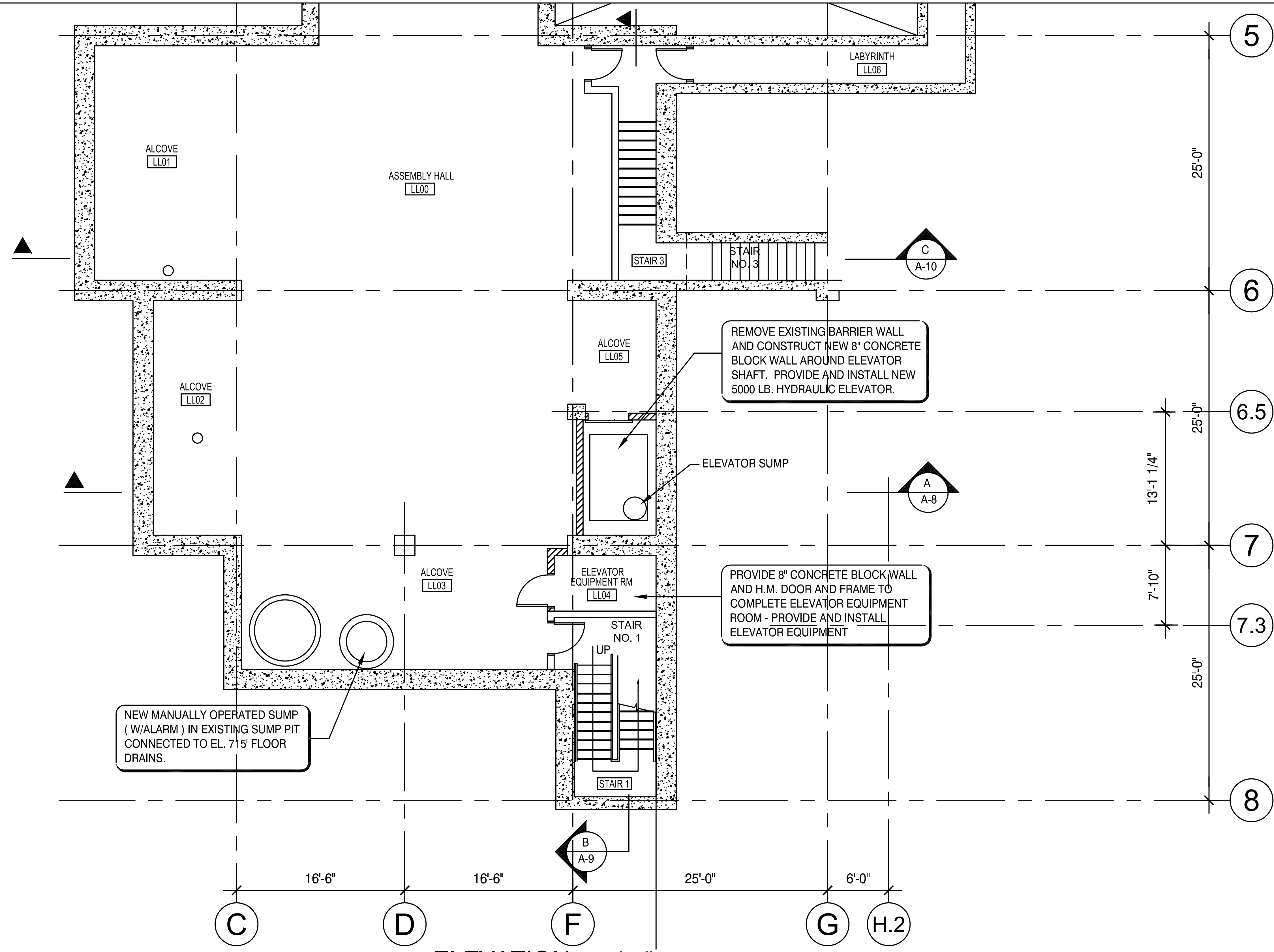

ELEVATION 715'-0"

REV.	DATE	DESCRIPTIONS

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SUBMITTED		

SCALE: 3/32"=1'-0"

4 0 4 8 12 16 20 24 28

SCALE FEET

S W E

PROJECT NORTH

FERMI NATIONAL ACCELERATOR LABORATORY

UNITED STATES DEPARTMENT OF ENERGY

C-O OUTFITTING

PLAN AT 715'-0"

DRAWING NO. **6-8-3** **CD-1 REVIEW** **A-1** REV.

APRIL 2004

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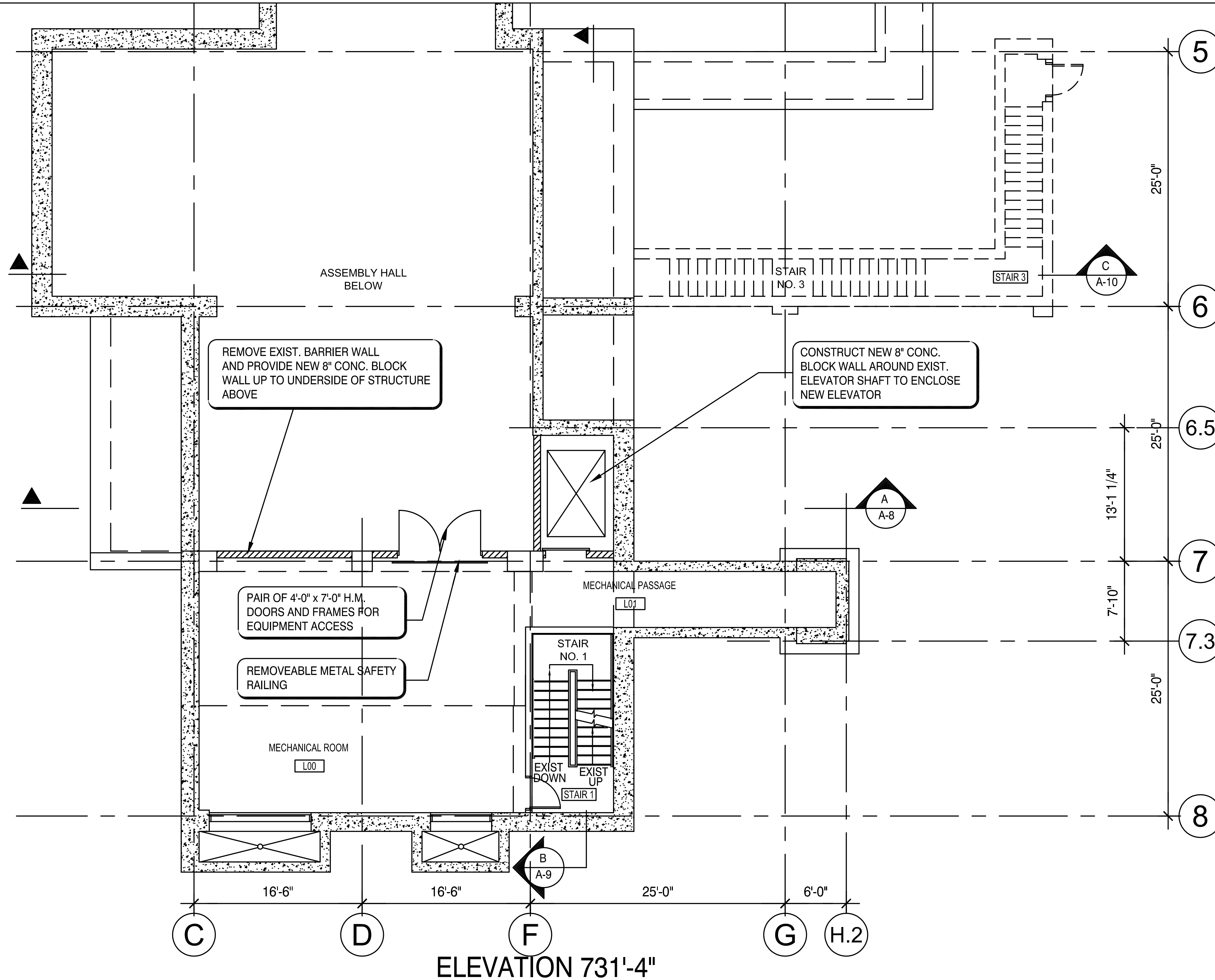

ELEVATION 731'-4"

Dwg: 6-8-B-TeV-CDR.dwg Plotted: 18DEC03 @ 07:47:14a.m.

REV.	DATE	DESCRIPTIONS
		REVISIONS

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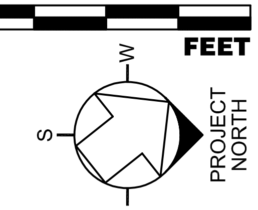
SCALE: 3/32"=1'-0"

4 0 4 8 12 16 20 24 28
SCALE FEET



FERMI NATIONAL ACCELERATOR LABORATORY

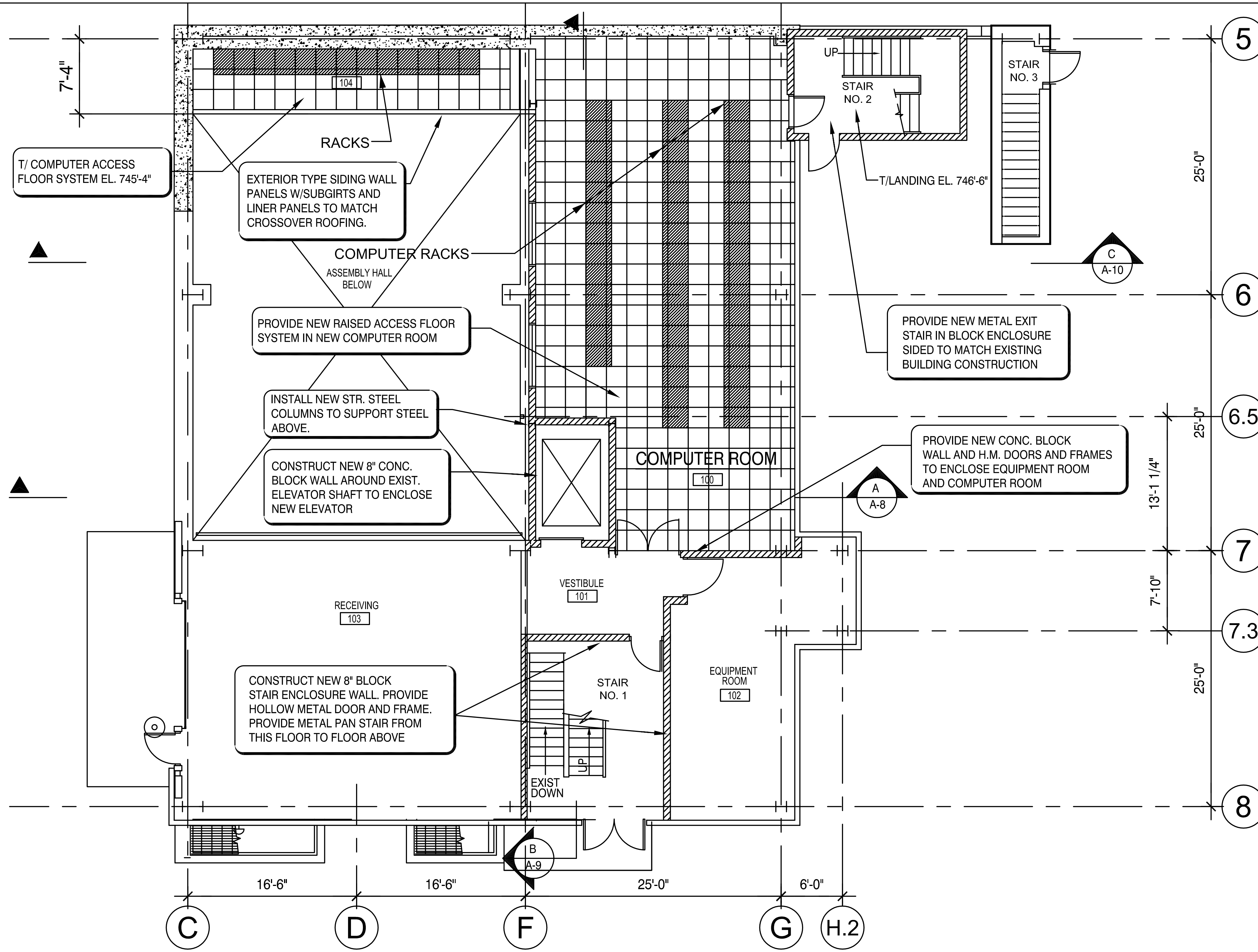
UNITED STATES DEPARTMENT OF ENERGY

C-O OUTFITTING

PLAN AT 731'-4"

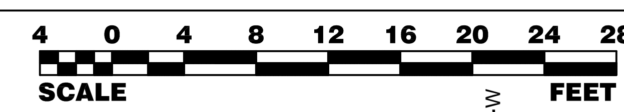
DRAWING NO. **6-8-3** **CD-1 REVIEW** **A-2** REV.

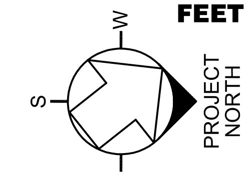
APRIL 2004



ELEVATION 746'-6" U.N.

SCALE: 3/32"=1'-0"





REV.	DATE	DESCRIPTIONS
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FERMI NATIONAL ACCELERATOR LABORATORY

UNITED STATES DEPARTMENT OF ENERGY

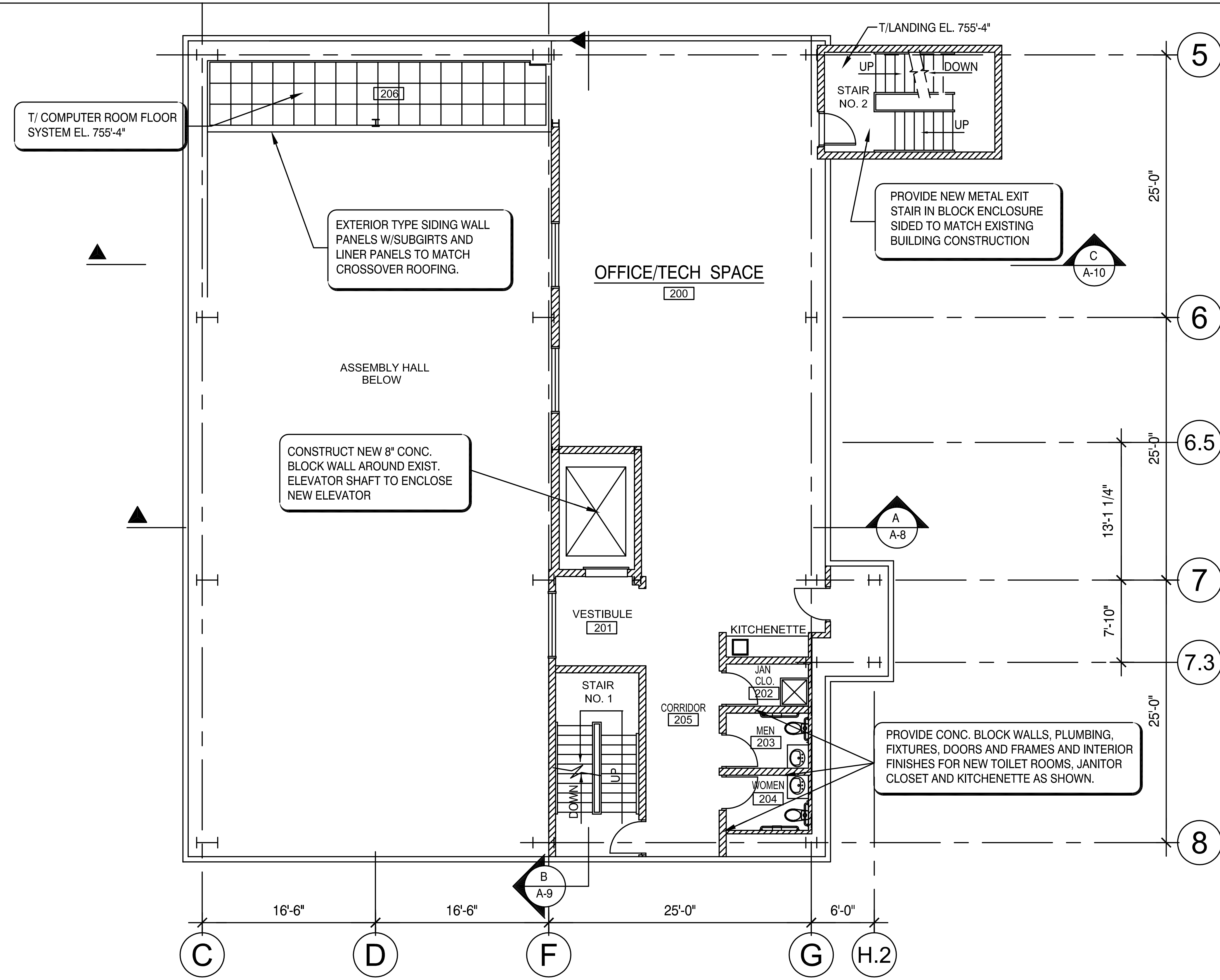
C-O OUTFITTING

PLAN AT 746'-6"

DRAWING NO. **6-8-3** **CD-1 REVIEW** **A-3** REV.

APRIL 2004

Dwg: 6-8-B-TeV-CDR.dwg Plotted: 18DEC03 @ 07:47:14a.m.



T/CONC. ELEVATION 755'-4"

Dwg: 6-8-B-TeV-CDR.dwg Plotted: 18DEC03 @ 07:47:14a.m.

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
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APPROVED		
SUBMITTED		

SCALE: 3/32"=1'-0"

4 0 4 8 12 16 20 24 28
SCALE FEET

W S E PROJECT NORTH

FERMI NATIONAL ACCELERATOR LABORATORY

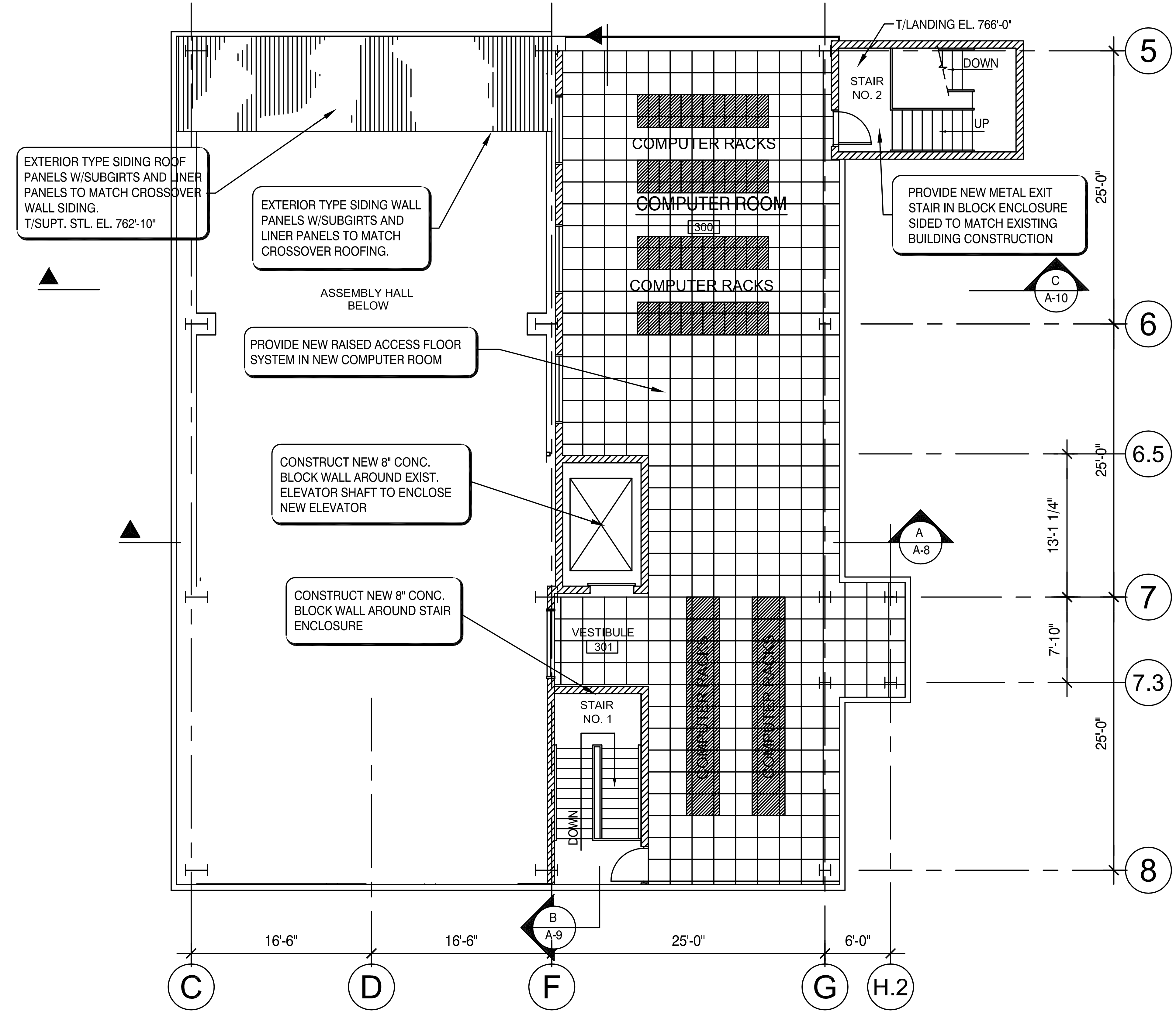
UNITED STATES DEPARTMENT OF ENERGY

C-O OUTFITTING

PLAN AT 755'-4"

DRAWING NO. **6-8-3** **CD-1 REVIEW** **A-4** REV.

APRIL 2004



T/COMP. FL. ELEVATION 766'-0"

SCALE: 3/32"=1'-0"

SCALE 4 0 4 8 12 16 20 24 28 FEET

W S E PROJECT NORTH

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
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SUBMITTED		

FERMI NATIONAL ACCELERATOR LABORATORY

UNITED STATES DEPARTMENT OF ENERGY

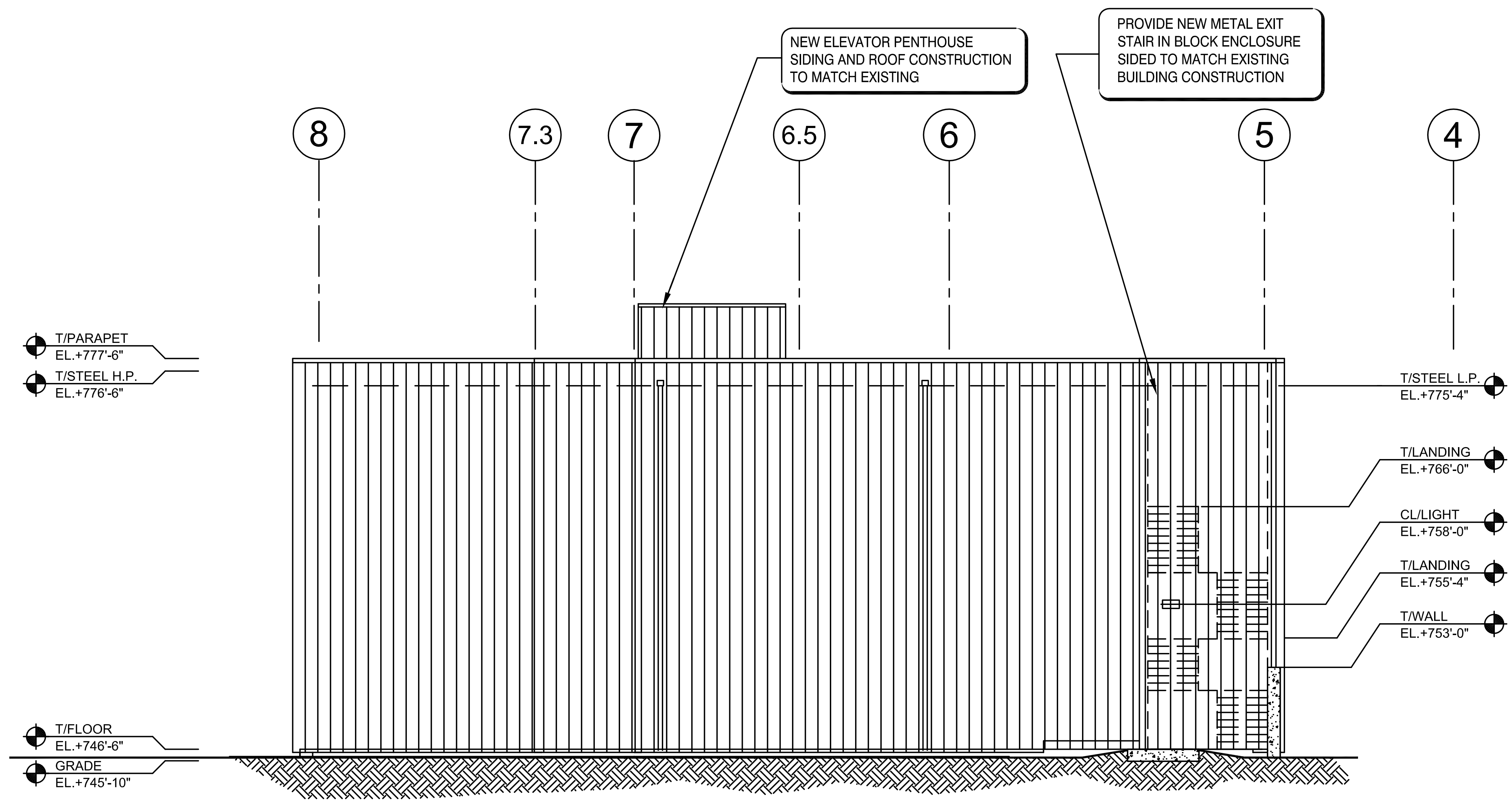
C-O OUTFITTING

PLAN AT 766'-0"

DRAWING NO. **6-8-3** **CD-1 REVIEW** **A-5** REV.

APRIL 2004

Dwg: 6-8-B-TeV-CDR.dwg Plotted: 18DEC03 @ 07:47:14a.m.



NORTH ELEVATION

LOOKING SOUTH

Dwg: 6-8-B-TeV-CDR.dwg Plotted: 18DEC03 @ 07:47:14a.m.

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE: 3/32"=1'-0"

SCALE 4 0 4 8 12 16 20 24 28 FEET

FERMI NATIONAL ACCELERATOR LABORATORY

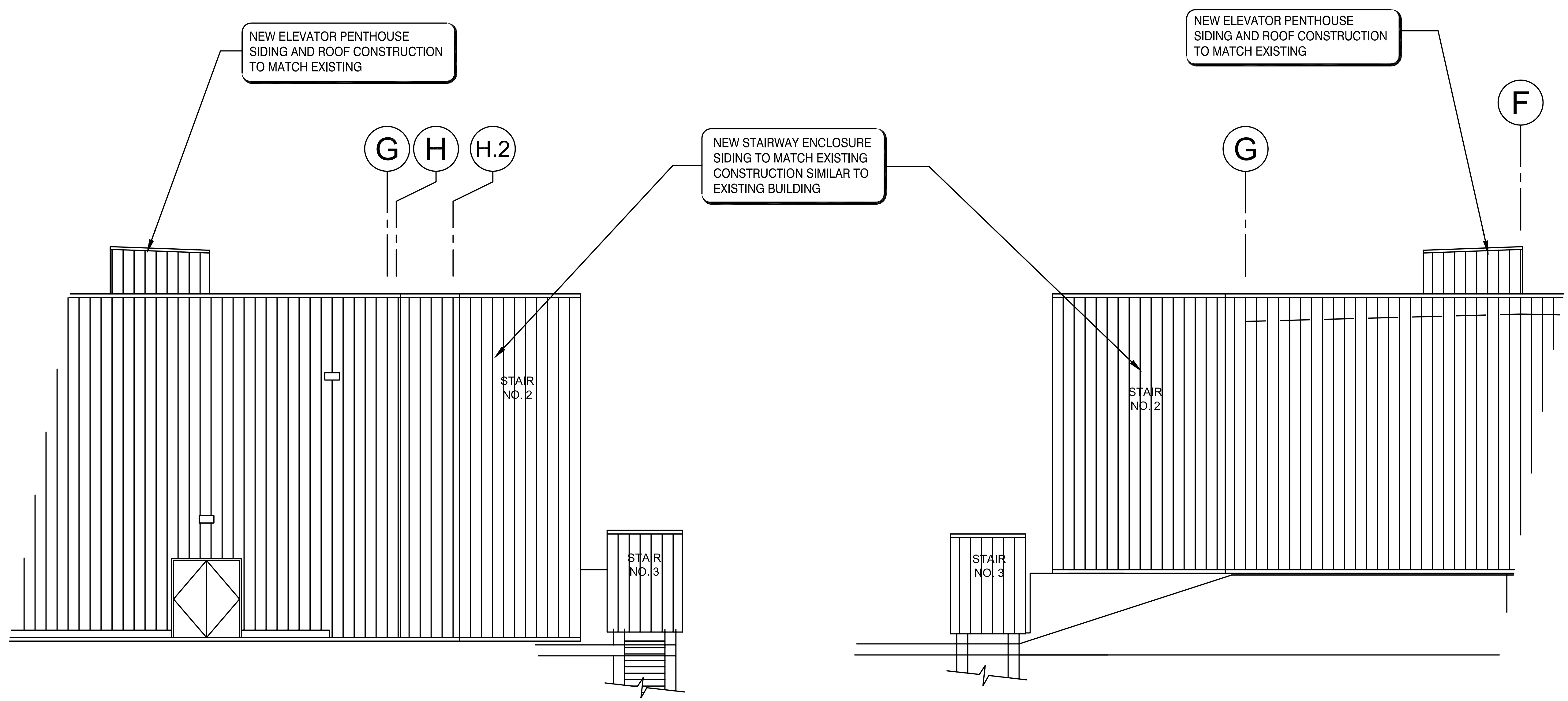
UNITED STATES DEPARTMENT OF ENERGY

C-O OUTFITTING

EXTERIOR ELEVATION - SHT. 1

DRAWING NO. **6-8-3** **CD-1 REVIEW** **A-6** REV.

APRIL 2004



EAST ELEVATION
LOOKING WEST

WEST ELEVATION
LOOKING EAST

Dwg: 6-8-B-TeV-CDR.dwg Plotted: 18DEC03 @ 07:47:14a.m.

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE:
3/32"=1'-0"

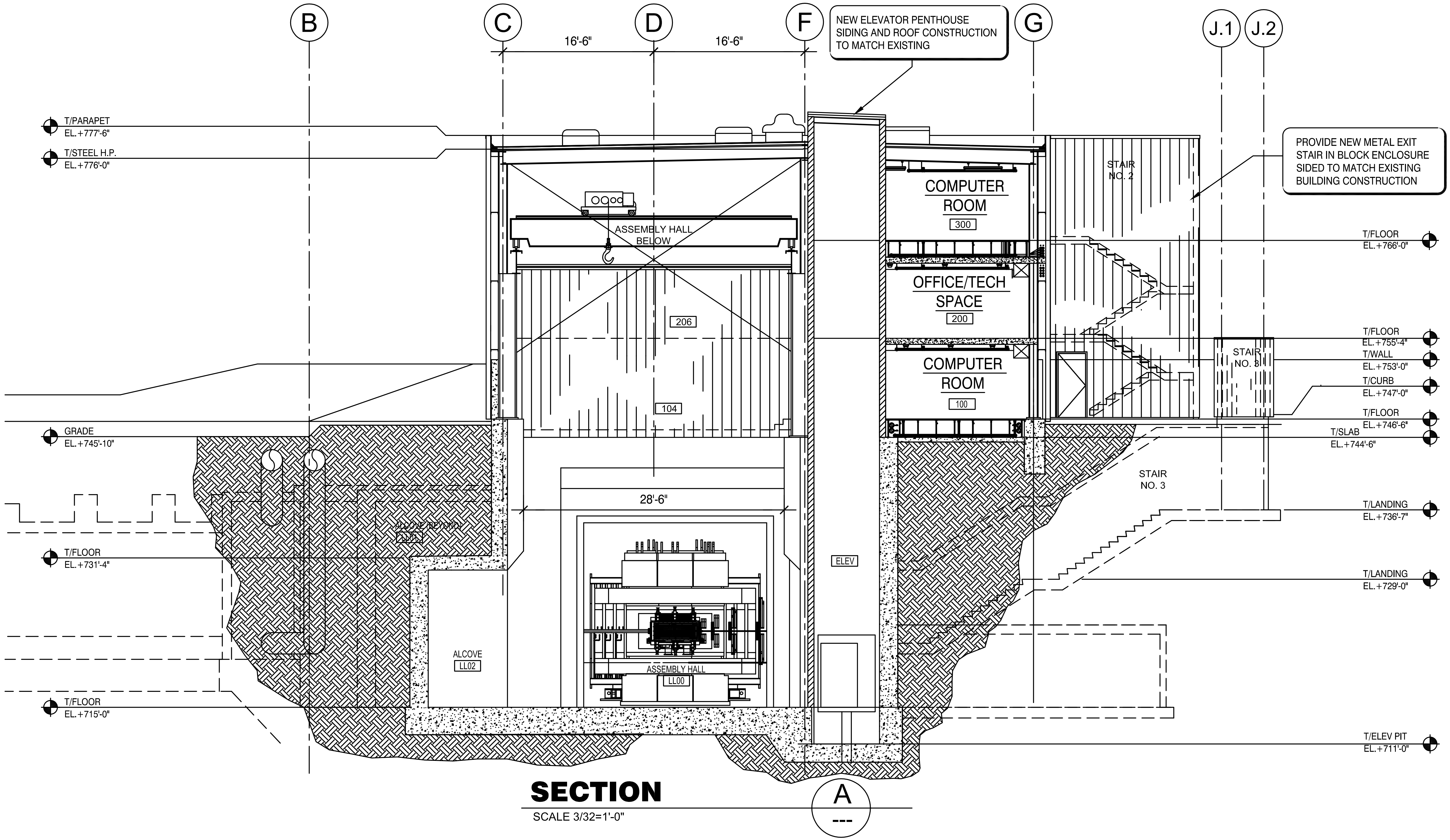
4 0 4 8 12 16 20 24 28
SCALE FEET

FERMI NATIONAL ACCELERATOR LABORATORY
UNITED STATES DEPARTMENT OF ENERGY

C-O OUTFITTING
EXTERIOR ELEVATIONS SHT. - 2

DRAWING NO. **6-8-3** **CD-1 REVIEW** **A-7** REV.

APRIL 2004



SECTION

SCALE 3/32=1'-0"

A

Dwg: 6-8-B-TeV-CDR.dwg Plotted: 18DEC03 @ 07:47:14a.m.

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE: 3/32"=1'-0"

4 0 4 8 12 16 20 24 28
SCALE FEET

FERMI NATIONAL ACCELERATOR LABORATORY

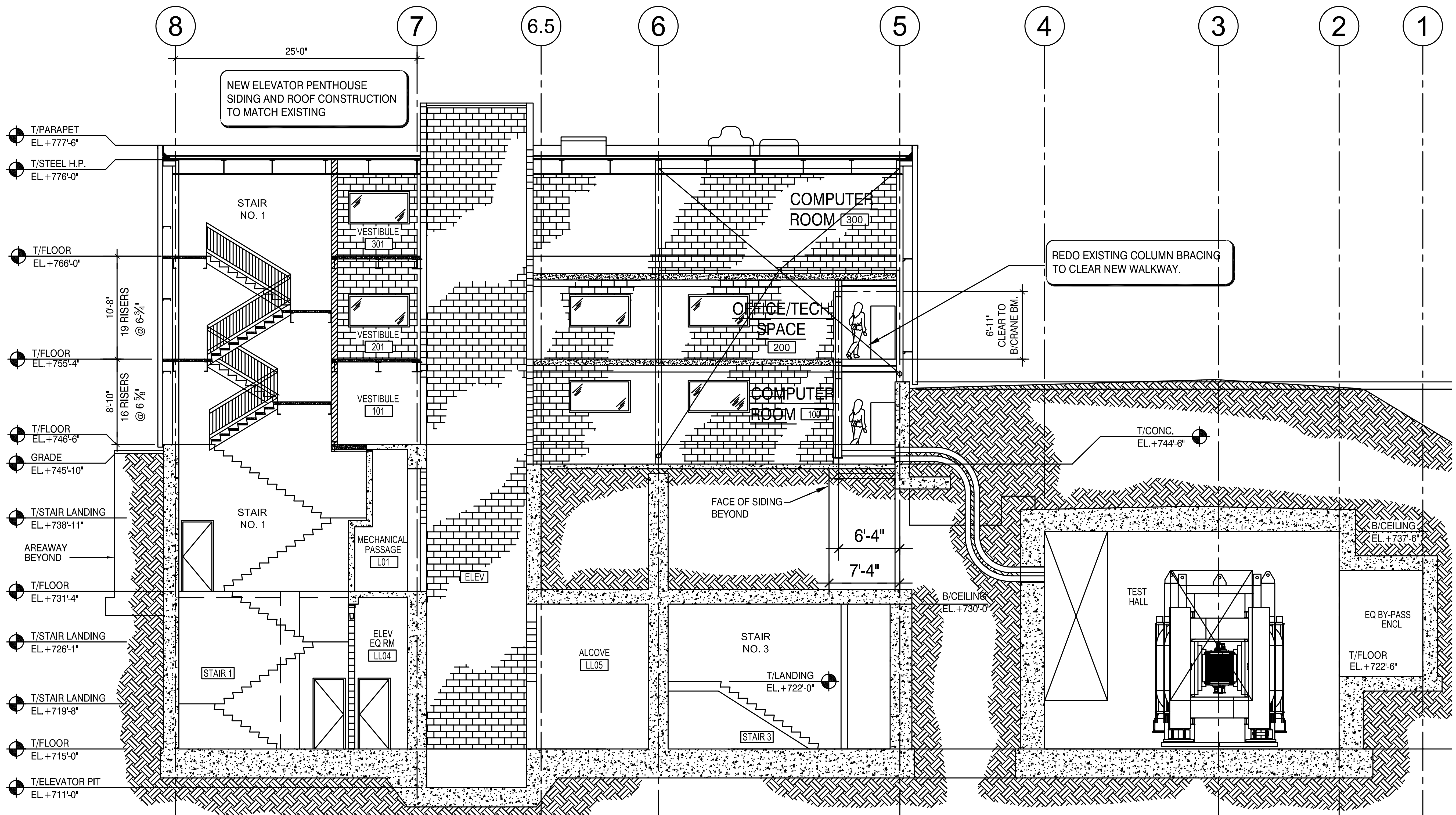
UNITED STATES DEPARTMENT OF ENERGY

C-O OUTFITTING

BUILDING SECTION SHT. - 1

DRAWING NO. **6-8-3** **CD-1 REVIEW** **A-8** REV.

APRIL 2004



SECTION

B

SCALE 3/32=1'-0"

Dwg: 6-8-B-TeV-CDR.dwg Plotted: 18DEC03 @ 07:47:14a.m.

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE: 3/32"=1'-0"

4 0 4 8 12 16 20 24 28
SCALE FEET

FERMI NATIONAL ACCELERATOR LABORATORY

UNITED STATES DEPARTMENT OF ENERGY

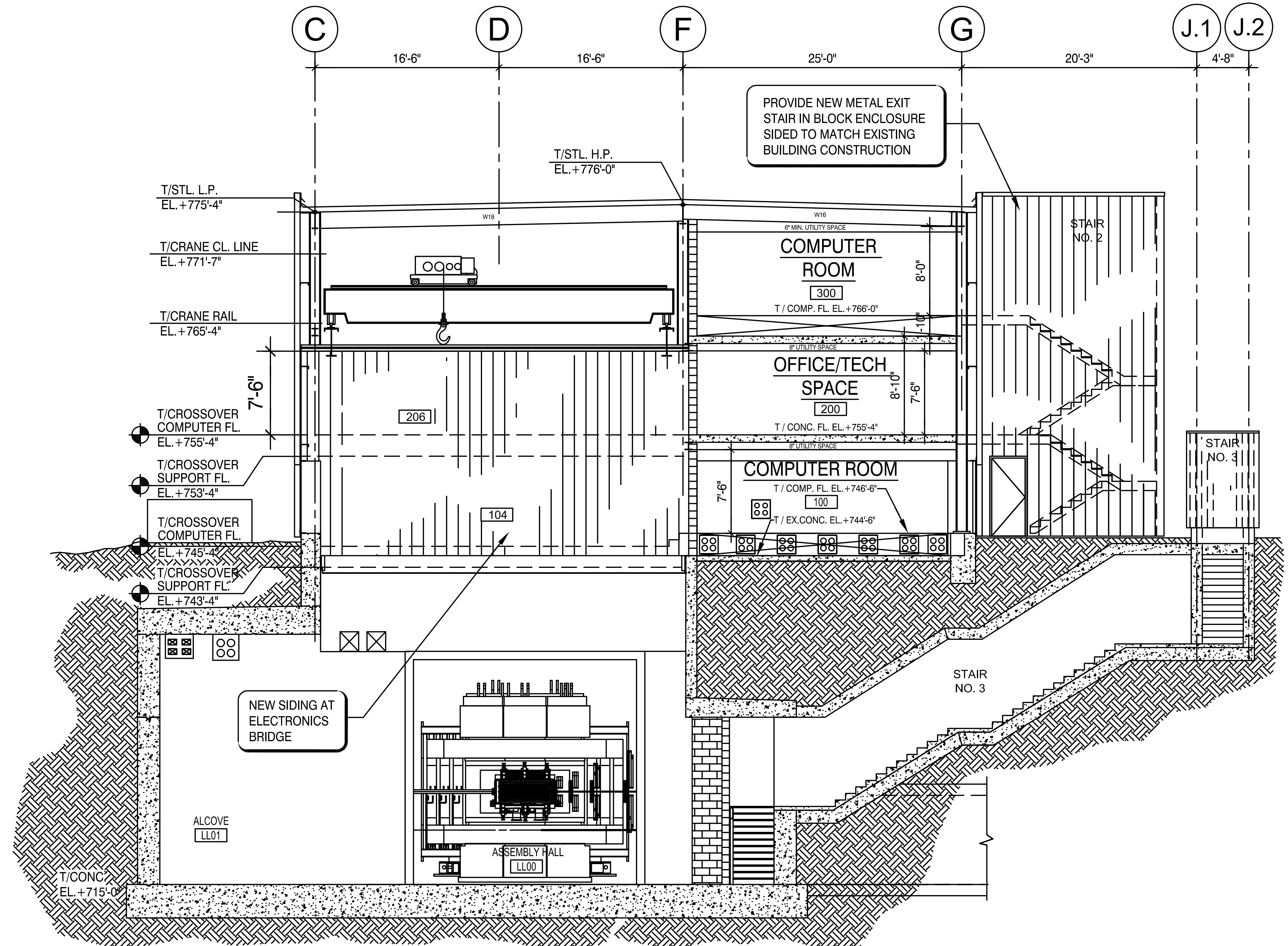
C-O OUTFITTING

BUILDING SECTION SHT. - 2

DRAWING NO. **6-8-3** **CD-1 REVIEW** **A-9** REV.

APRIL 2004

Dwg: 6-8-B-TeV-CDR.dwg Plotted: 18DEC03 @ 07:47:14a.m.



SECTION

SCALE 3/32=1'-0"

C / A-1 A-2 A-3 A-4 A-5

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE: 3/32"=1'-0"

4 0 4 8 12 16 20 24 28

SCALE FEET

FERMI NATIONAL ACCELERATOR LABORATORY

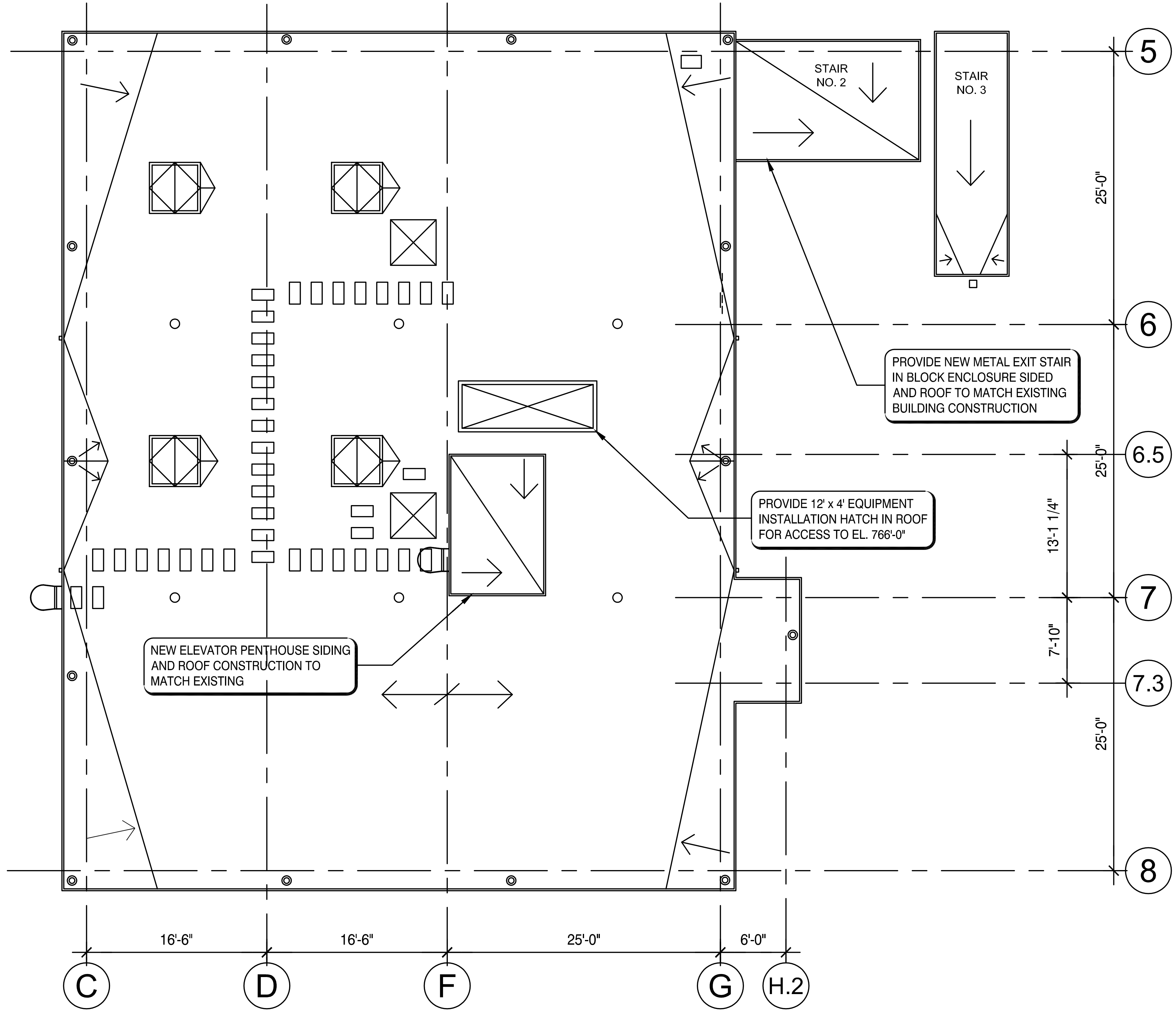
UNITED STATES DEPARTMENT OF ENERGY

C-O OUTFITTING

BUILDING SECTION SHT. - 3

DRAWING NO. **6-8-3** **CD-1 REVIEW** **A-10** REV.

APRIL 2004



T/EX. ROOF PLAN ELEVATION 776'-5""

Dwg: 6-8-B-TeV-CDR.dwg Plotted: 18DEC03 @ 07:47:14a.m.

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE: 3/32"=1'-0"

SCALE 4 0 4 8 12 16 20 24 28 **FEET**

W S E PROJECT NORTH

FERMI NATIONAL ACCELERATOR LABORATORY

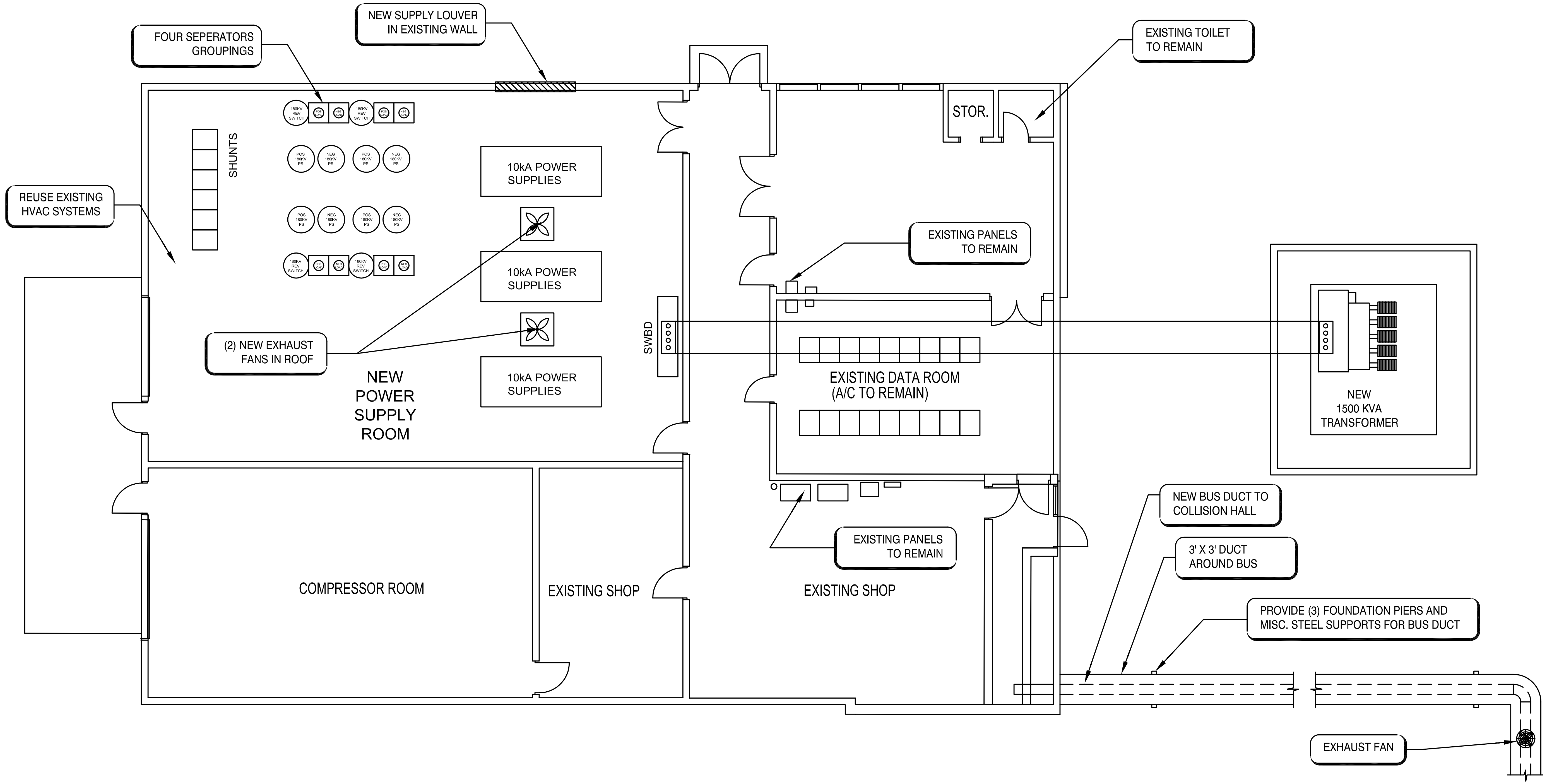
UNITED STATES DEPARTMENT OF ENERGY

C-O OUTFITTING

ROOF PLAN AT H.P. EL. 776'-5"

DRAWING NO. **6-8-3** **CD-1 REVIEW** **A-11** REV.

APRIL 2004



EXISTING C0 SERVICE BLDG. - T/FLOOR 744'-0"

Dwg: 6-8-B-TeV-CDR.dwg Plotted: 18DEC03 @ 07:47:14a.m.

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE: **3/32"=1'-0"**

4 0 4 8 12 16 20 24 28
SCALE **FEET**

W S E PROJECT NORTH

FERMI NATIONAL ACCELERATOR LABORATORY

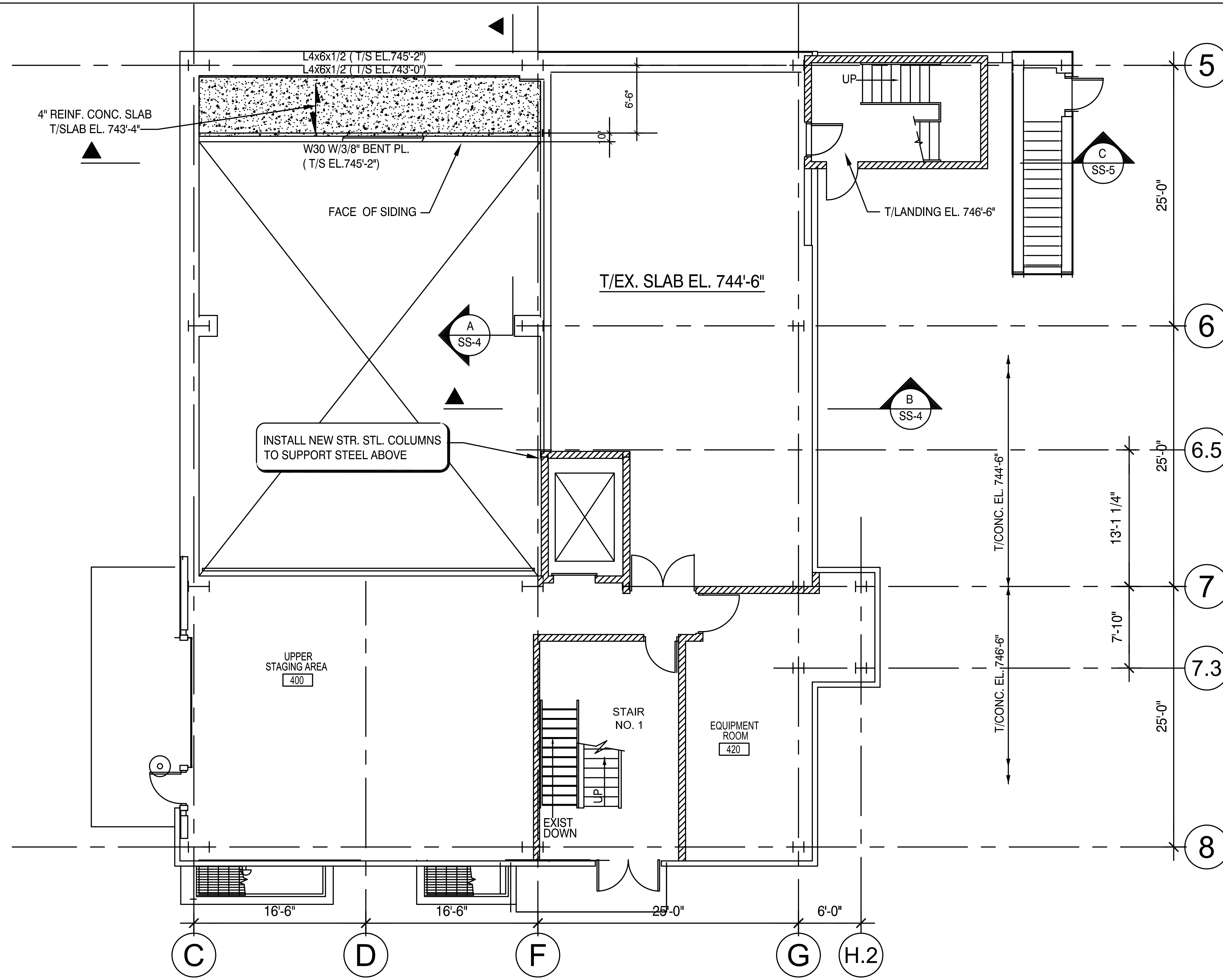
UNITED STATES DEPARTMENT OF ENERGY

C-0 OUTFITTING

C-0 SERVICE BLDB. PLAN @ EL. 744'-0"

DRAWING NO. **6-8-3** **CD-1 REVIEW** **A-12** REV.

APRIL 2004



T/EX. CONC. ELEVATION 746-6" U.N. (T/STL. AS NOTED)

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE: 3/32"=1'-0"

SCALE 4 0 4 8 12 16 20 24 28 FEET

S W E PROJECT NORTH

FERMI NATIONAL ACCELERATOR LABORATORY

UNITED STATES DEPARTMENT OF ENERGY

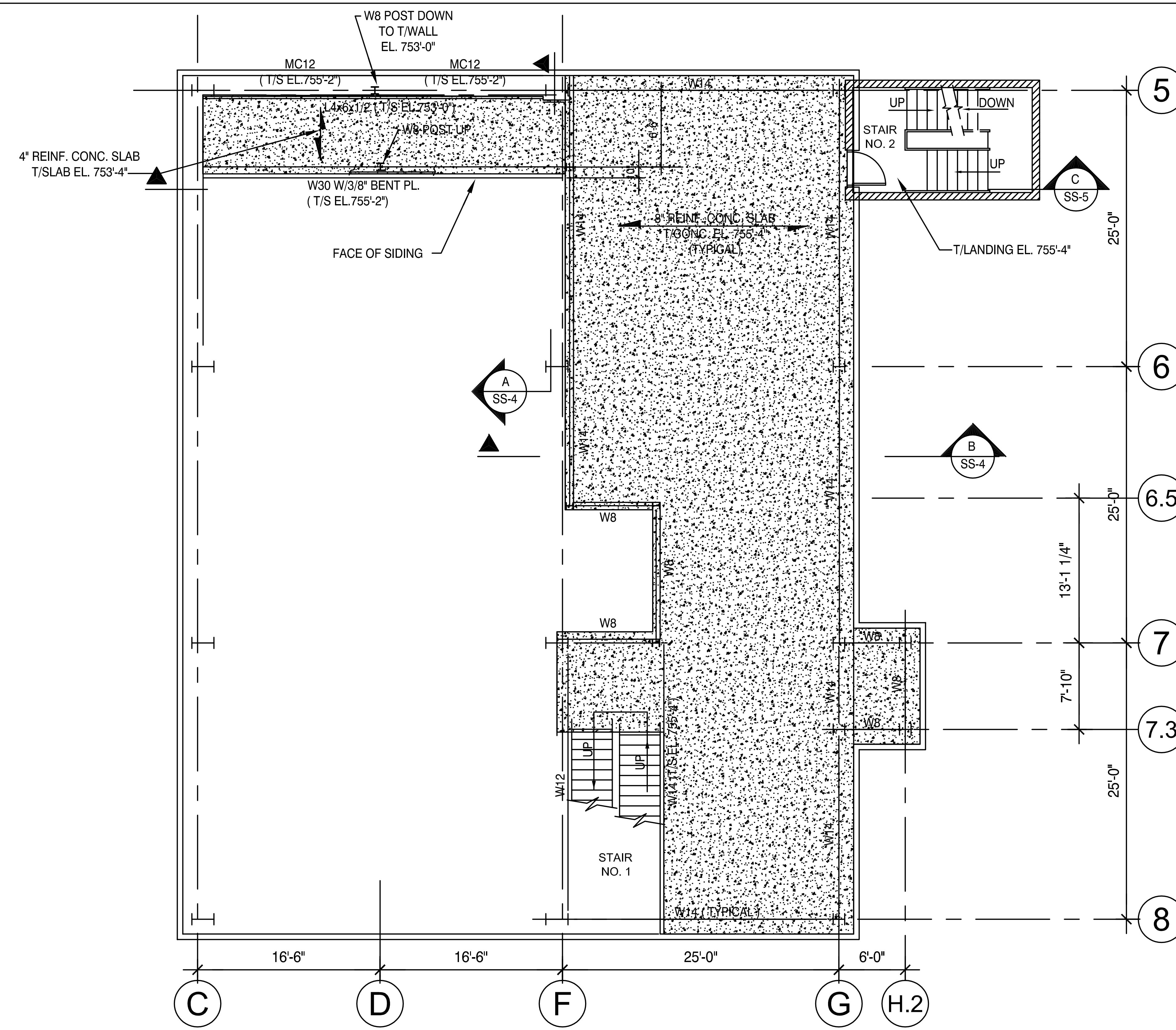
C-O OUTFITTING

STRUCTURAL PLAN AT 744'-6"

DRAWING NO. **6-8-3** **CD-1 REVIEW** **SS-1** REV.

APRIL 2004

Dwg: 6-8-B-TeV-CDR.dwg Plotted: 18DEC03 @ 07:47:14a.m.



T/CONC. ELEVATION 755'-4" (T/STL. -8" U.N.)

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE: **3/32"=1'-0"**

4 0 4 8 12 16 20 24 28
SCALE **FEET**

W S E PROJECT NORTH

FERMI NATIONAL ACCELERATOR LABORATORY

UNITED STATES DEPARTMENT OF ENERGY

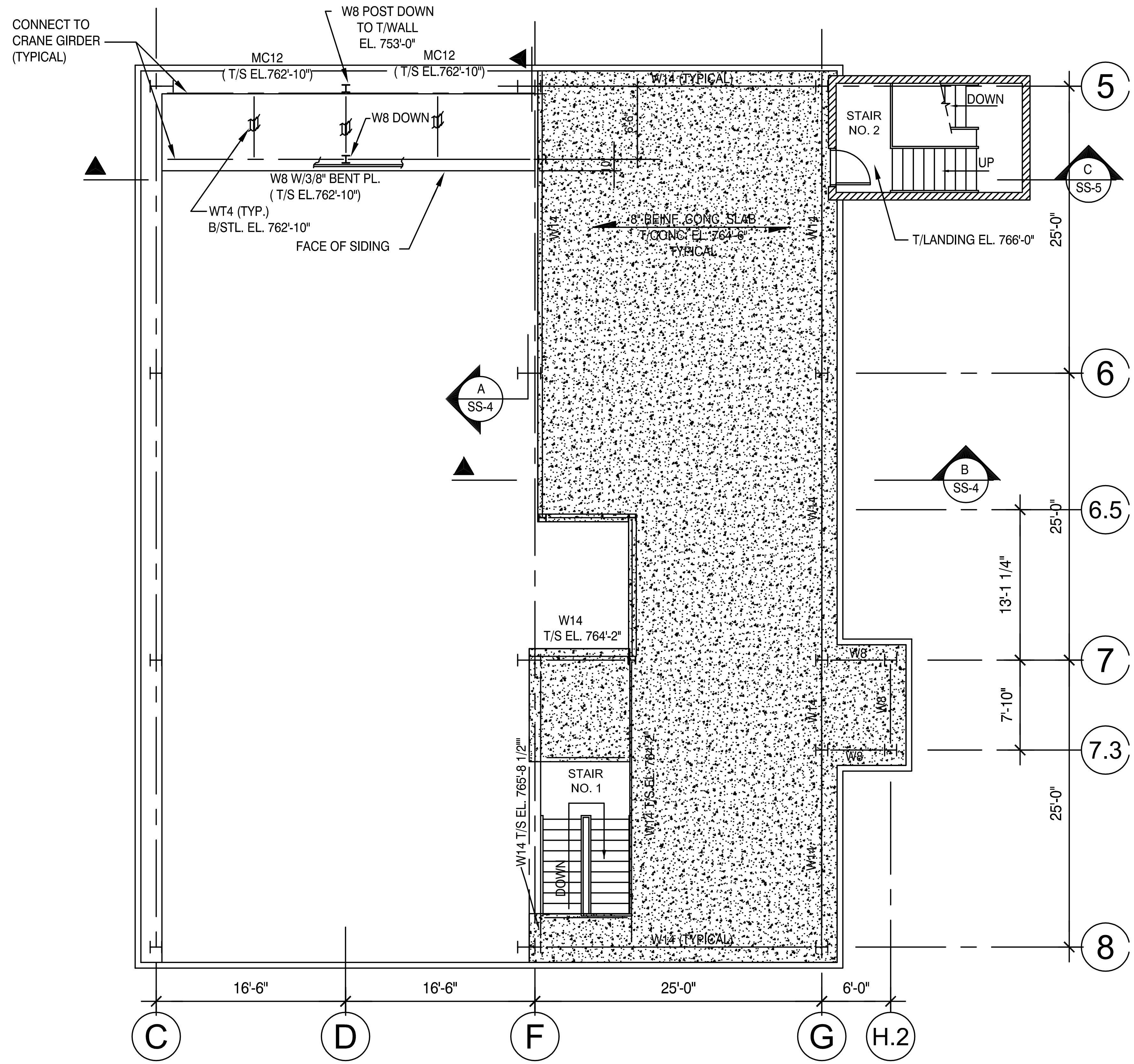
C-O OUTFITTING

STRUCTURAL PLAN AT 755'-4"

DRAWING NO. **6-8-3** **CD-1 REVIEW** **SS-2** REV.

APRIL 2004

Dwg: 6-8-B-TeV-CDR.dwg Plotted: 18DEC03 @ 07:47:14a.m.



T/CONC. ELEVATION 764'-2" (T/STL. -8" U.N.)

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE: 3/32"=1'-0"

4 0 4 8 12 16 20 24 28
SCALE FEET

PROJECT NORTH
W S E

FERMI NATIONAL ACCELERATOR LABORATORY

UNITED STATES DEPARTMENT OF ENERGY

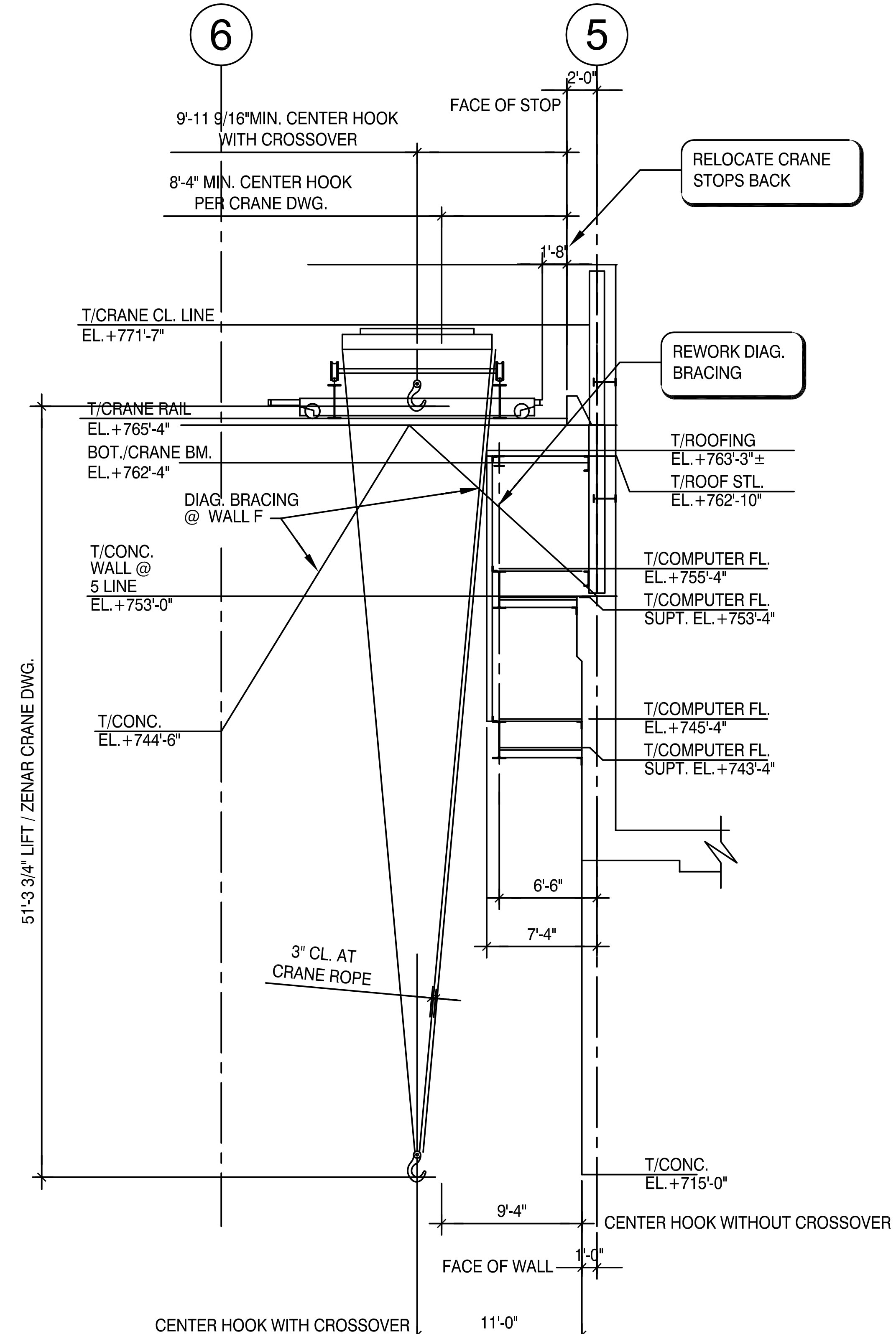
C-O OUTFITTING

STRUCTURAL PLAN AT 764'-2"

DRAWING NO. **6-8-3** **CD-1 REVIEW** **SS-3** REV.

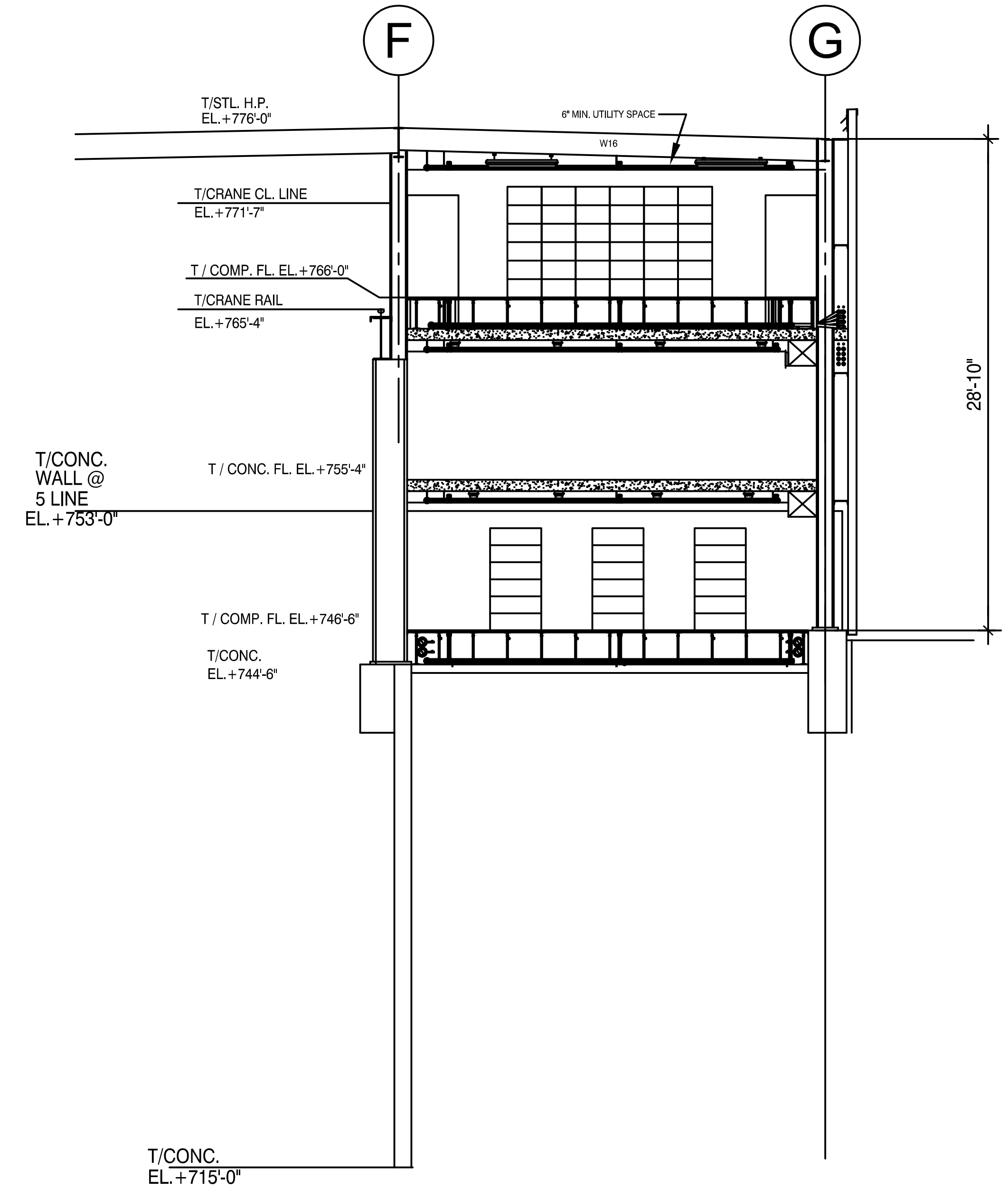
APRIL 2004

Dwg: 6-8-B-TeV-CDR.dwg Plotted: 18DEC03 @ 07:47:14a.m.



SECTION A SS-1 SS-2 SS-3

SCALE 3/32=1'-0"



SECTION B SS-1 SS-2 SS-3

SCALE 3/32=1'-0"

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE: 3/32"=1'-0"

4 0 4 8 12 16 20 24 28
SCALE **FEET**

FERMI NATIONAL ACCELERATOR LABORATORY

UNITED STATES DEPARTMENT OF ENERGY

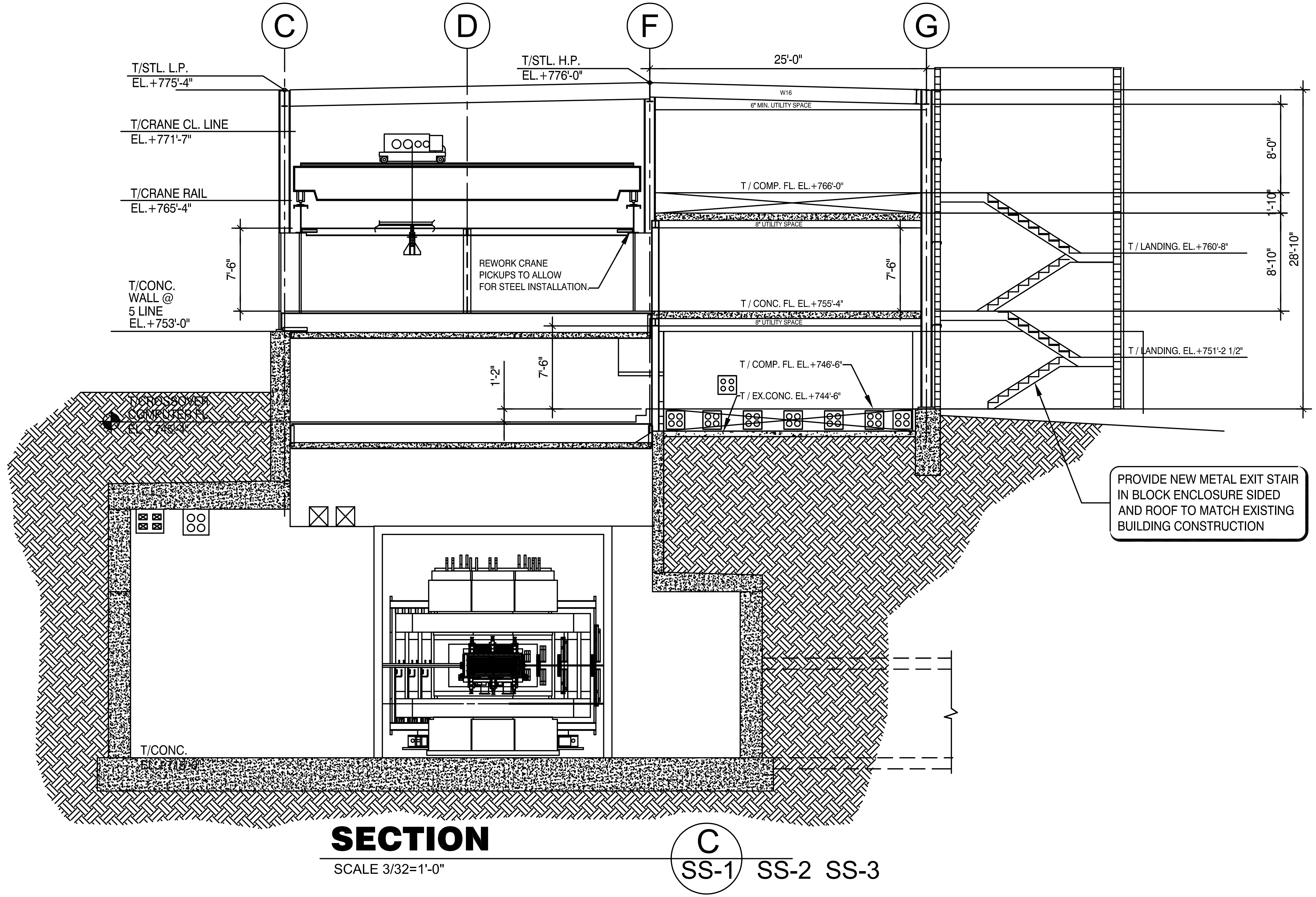
C-O OUTFITTING

BUILDING SECTIONS - SHT. 1

DRAWING NO. **6-8-3** **CD-1 REVIEW** **SS-4** REV.

APRIL 2004

Dwg: 6-8-B-TeV-CDR.dwg Plotted: 18DEC03 @ 07:47:14a.m.



SECTION

SCALE 3/32=1'-0"

C
SS-1 SS-2 SS-3

Dwg: 6-8-B-TeV-CDR.dwg Plotted: 18DEC03 @ 07:47:14a.m.

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE: 3/32"=1'-0"

SCALE 4 0 4 8 12 16 20 24 28 FEET

FERMI NATIONAL ACCELERATOR LABORATORY

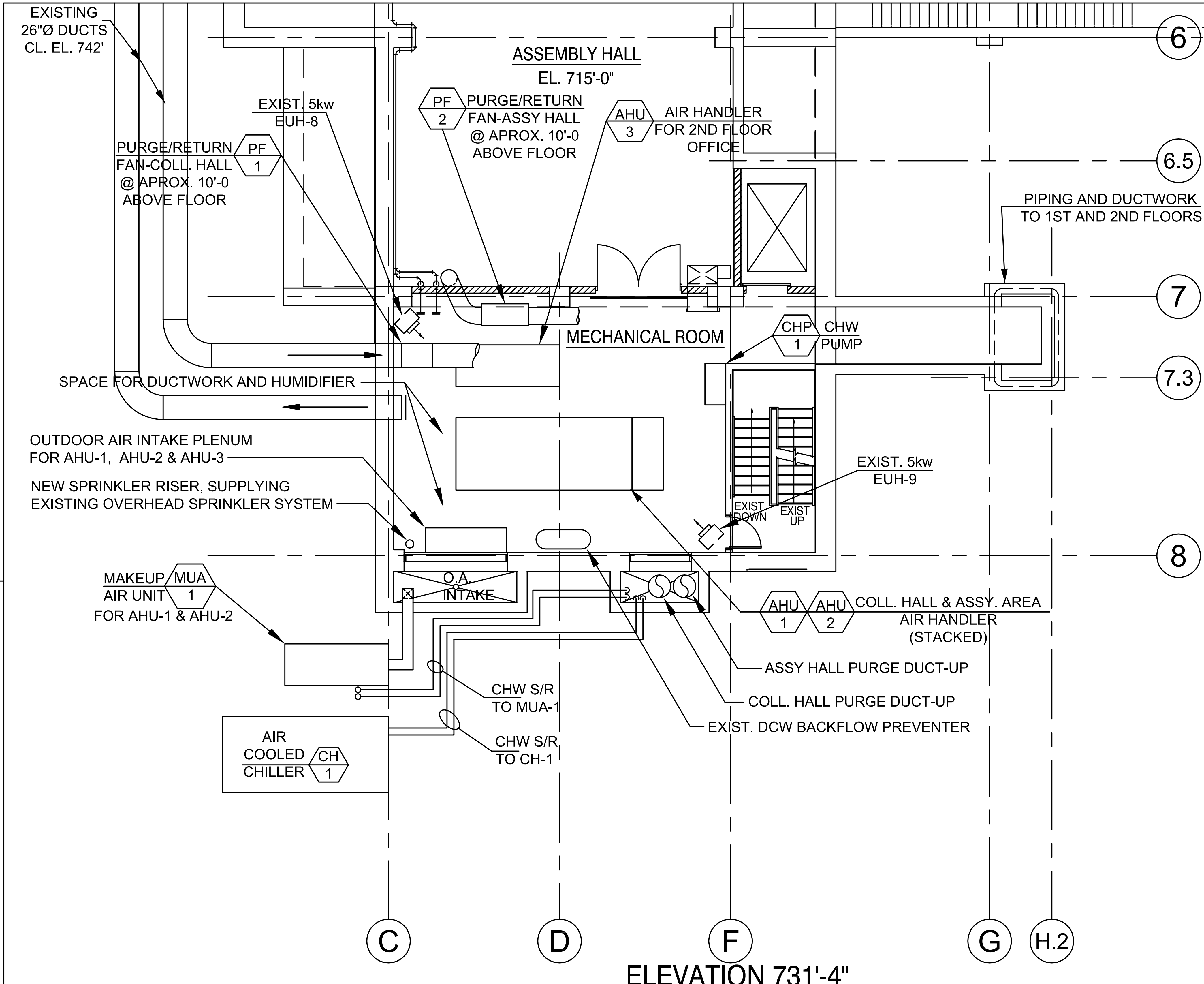
UNITED STATES DEPARTMENT OF ENERGY

C-O OUTFITTING

BUILDING SECTIONS - SHT. 2

DRAWING NO. **6-8-3** **CD-1 REVIEW** **SS-5** REV.

APRIL 2004



MECHANICAL ROOM

MECHANICAL HVAC CRITERIA

ENVIRONMENT----- HEATING & VENTILATION
TEMPERATURE --- 60° F to 80°F
HUMIDITY------------ UNCONTROLLED
OCCUPANCY-------- 0

FIRE PROTECTION CRITERIA

- PROVIDE NEW WET-TYPE AUTOMATIC SPRINKLER SYSTEM DESIGNED TO O.H. PROTECT MECHANICAL ROOM.

GAS SHED (NOT SHOWN)

MECHANICAL HVAC CRITERIA

-------------NONE----------

FIRE PROTECTION CRITERIA

-------------NONE------------

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE: 3/32"=1'-0"

4 0 4 8 12 16 20 24 28
SCALE FEET

S W E PROJECT NORTH

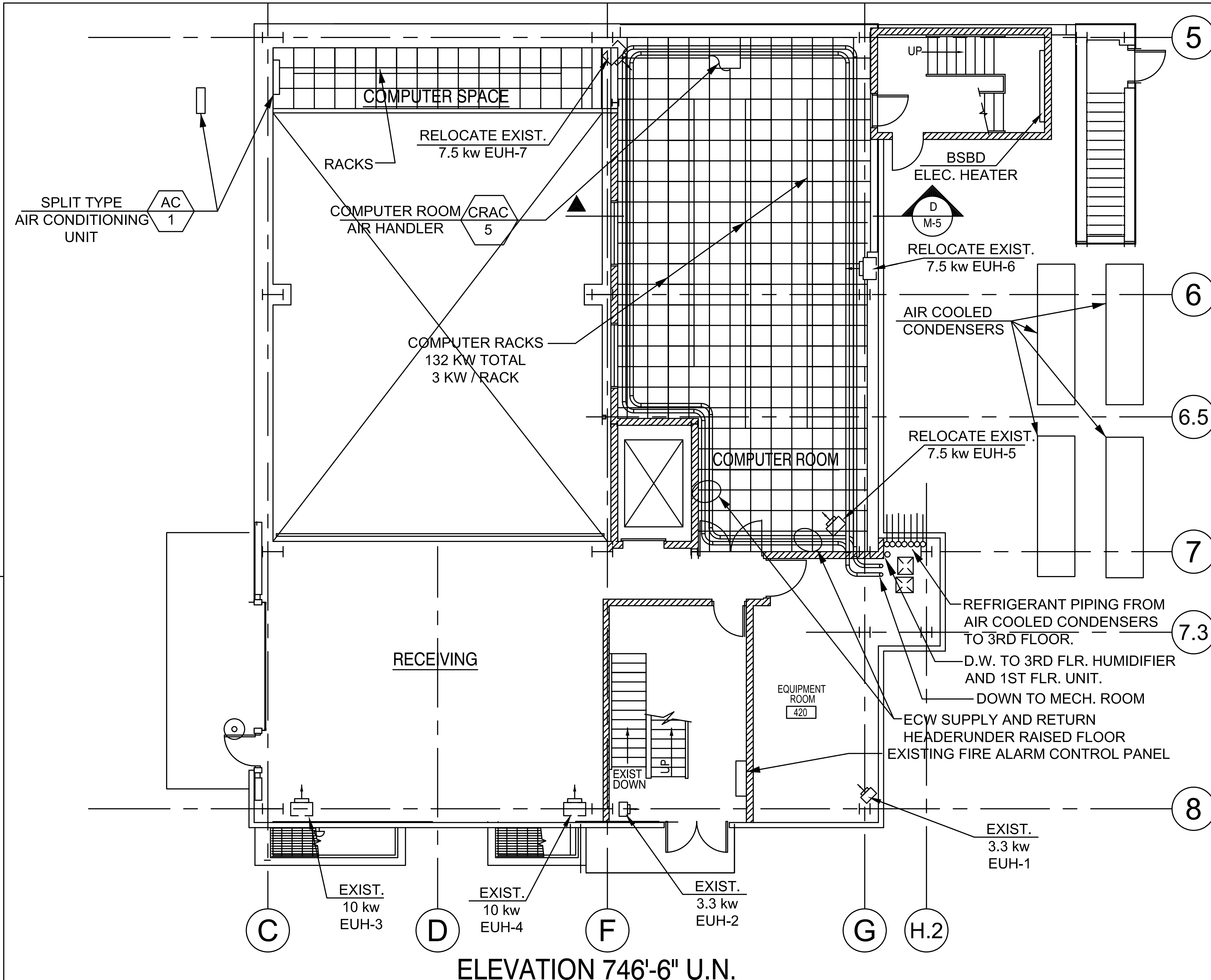
FERMI NATIONAL ACCELERATOR LABORATORY
UNITED STATES DEPARTMENT OF ENERGY

C-O OUTFITTING
MECHANICAL - PLAN AT EL. 731'-4"

DRAWING NO. **6-8-3** **CD-1 REVIEW** **M-1** REV.

APRIL 2004

Dwg: 6-8-B-TeV-CDR.dwg Plotted: 18DEC03 @ 07:47:14a.m.



ELEVATION 746'-6" U.N.

1ST FLOOR COMPUTER ROOM

MECHANICAL HVAC CRITERIA

TEMPERATURE --- 75° F
HUMIDITY------------ 50% RH
OCCUPANCY-------- 5
EQUIP. LOAD ------ 132 KW TOTAL (55° F ECW SUPPLY NON CONDENSING TO RACKS)

FIRE PROTECTION CRITERIA

- PROVIDE HIGH VELOCITY SPOT TYPE SMOKE DETECTION ABOVE & BELOW RAISED FLOOR PER NFPA-72.
- PROVIDE WET-TYPE AUTOMATIC SPRINKLER SYSTEM BELOW RAISED FLOOR PER NFPA-13.
- PROVIDE NEW WET-TYPE AUTOMATIC SPRINKLER SYSTEM DESIGNED TO AN ORDINARY HAZARD PER NFPA-13.

UPPER STAGING AREA

MECHANICAL HVAC CRITERIA

HEATING ONLY

FIRE PROTECTION CRITERIA

- EXISTING SYSTEM

EQUIPMENT ROOM

MECHANICAL HVAC CRITERIA

-----NONE-----

FIRE PROTECTION CRITERIA

- PROVIDE NEW WET-TYPE AUTOMATIC SPRINKLER SYSTEM DESIGNED TO AN ORDINARY HAZARD PER NFPA-13.

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE: 3/32"=1'-0"

SCALE 4 0 4 8 12 16 20 24 28 FEET

S W E PROJECT NORTH

FERMI NATIONAL ACCELERATOR LABORATORY

UNITED STATES DEPARTMENT OF ENERGY

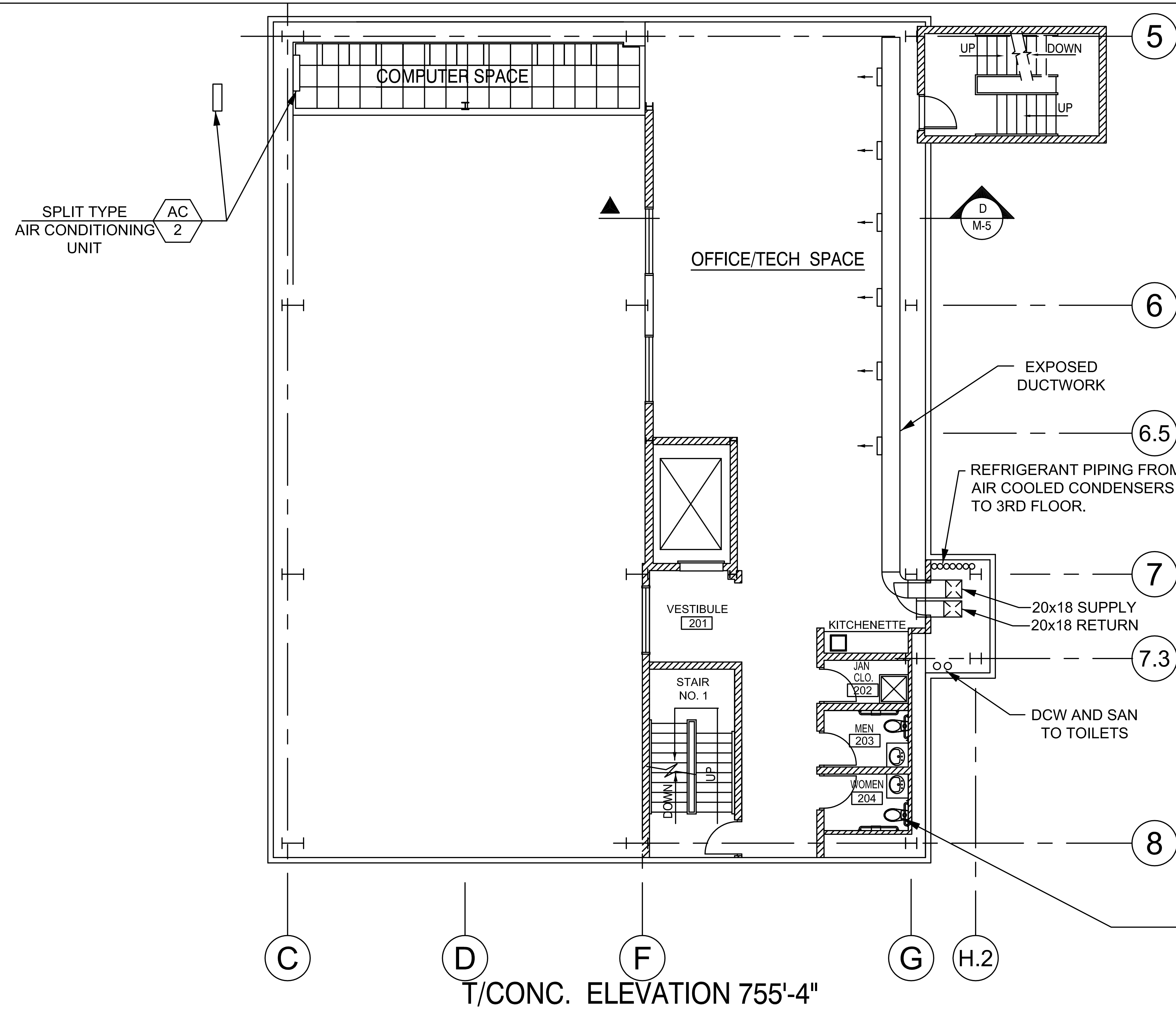
C-O OUTFITTING

MECHANICAL - PLAN AT EL. 746'-6"

DRAWING NO. **6-8-3** **CD-1 REVIEW** **M-2** REV.

APRIL 2004

Dwg: 6-8-B-TeV-CDR.dwg Plotted: 18DEC03 @ 07:47:14a.m.



2ND FLOOR OFFICE SPACE

MECHANICAL HVAC CRITERIA

ENVIRONMENT ---------HVAC
TEMP/HUMIDITY--------78 F/50%RH SUMMER
& 68 F WINTER
OCCUPANCY-------- 25
(500 CFM OUTSIDE AIR REQUIRED)

FIRE PROTECTION CRITERIA

- PROVIDE HIGH VELOCITY SPOT TYPE SMOKE DETECTION PER NFPA-72.
- PROVIDE NEW WET-TYPE AUTOMATIC SPRINKLER SYSTEM DESIGNED TO AN ORDINARY HAZARD PER NFPA-13.

PLUMBING CRITERIA

- ALL PLUMBING SHALL BE INSTALLED IN ACCORDANCE WITH THE ILLINOIS PLUMBING CODE..

REV.	DATE	DESCRIPTIONS

REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE: 3/32"=1'-0"

SCALE 4 0 4 8 12 16 20 24 28 **FEET**

PROJECT NORTH

FERMI NATIONAL ACCELERATOR LABORATORY

UNITED STATES DEPARTMENT OF ENERGY

C-O OUTFITTING

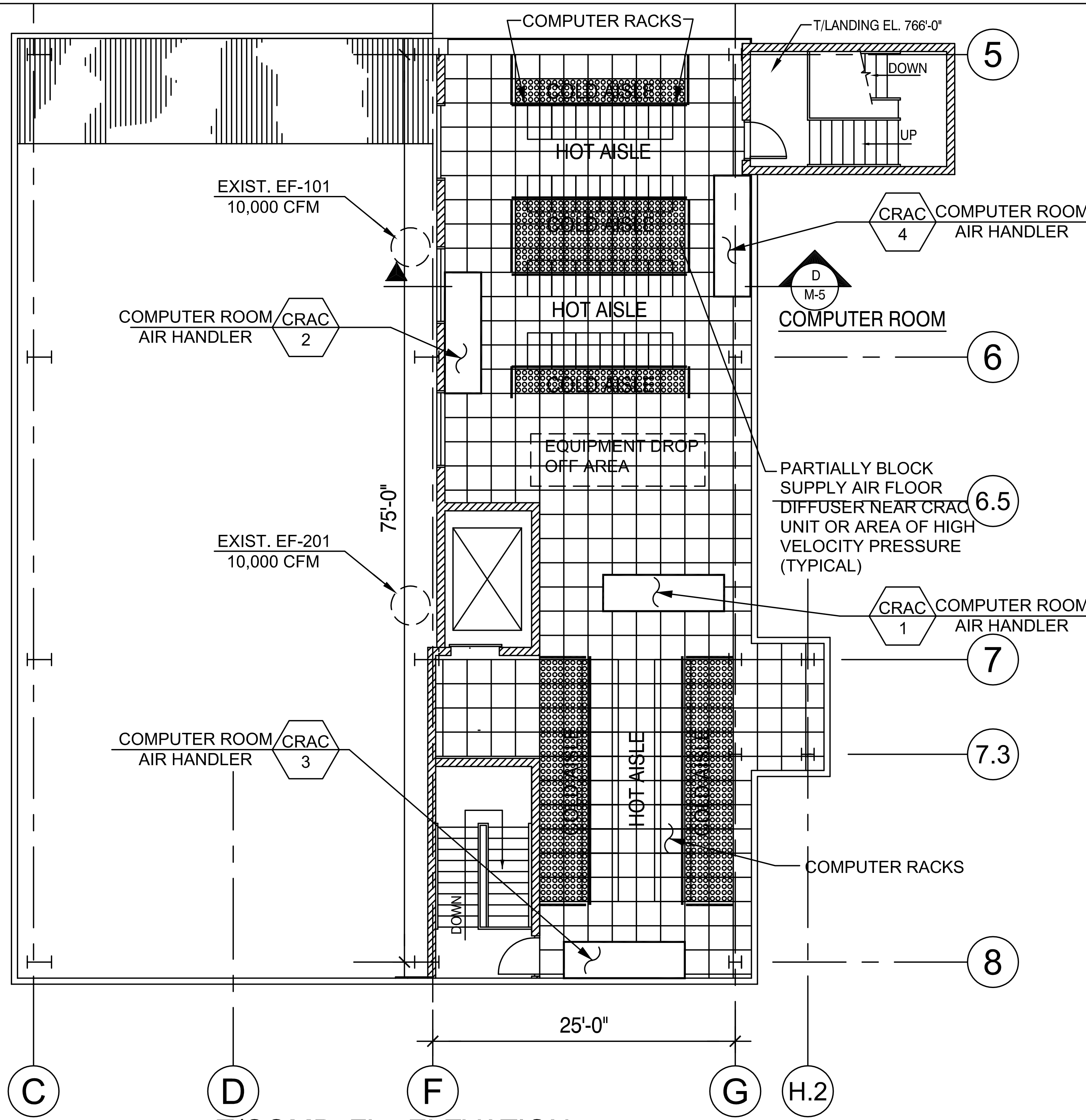
MECHANICAL - PLAN AT EL. 755'-4"

DRAWING NO. **6-8-3** **CD-1 REVIEW** **M-3** REV.

APRIL 2004

Dwg: 6-8-B-TeV-CDR.dwg Plotted: 18DEC03 @ 07:47:14a.m.

Dwg: 6-8-B-TeV-CDR.dwg Plotted: 18DEC03 @ 07:47:14a.m.



T/COMP. FL. ELEVATION 766'-0"

3RD FLOOR HIGH DENSITY COMPUTER ROOM

MECHANICAL HVAC CRITERIA

ENVIRONMENT------------HVAC
TEMP./HUMIDITY---------72°/45% RH ±5%RH (SUMMER & WINTER)
OCCUPANCY-------- 5
EQUIP. LOAD ------ ~342 TO 350 KW

FIRE PROTECTION CRITERIA

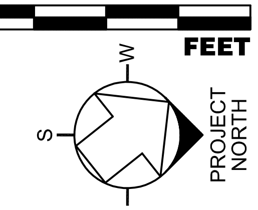
- PROVIDE HIGH VELOCITY SPOT TYPE SMOKE DETECTION ABOVE & BELOW RAISED FLOOR PER NFPA-72.
- PROVIDE WET-TYPE AUTOMATIC SPRINKLER SYSTEM BELOW RAISED FLOOR PER NFPA-13.
- PROVIDE NEW WET-TYPE AUTOMATIC SPRINKLER SYSTEM DESIGNED TO AN ORDINARY HAZARD PER NFPA-13.

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE: 3/32"=1'-0"

SCALE 4 0 4 8 12 16 20 24 28 FEET



FERMI NATIONAL ACCELERATOR LABORATORY

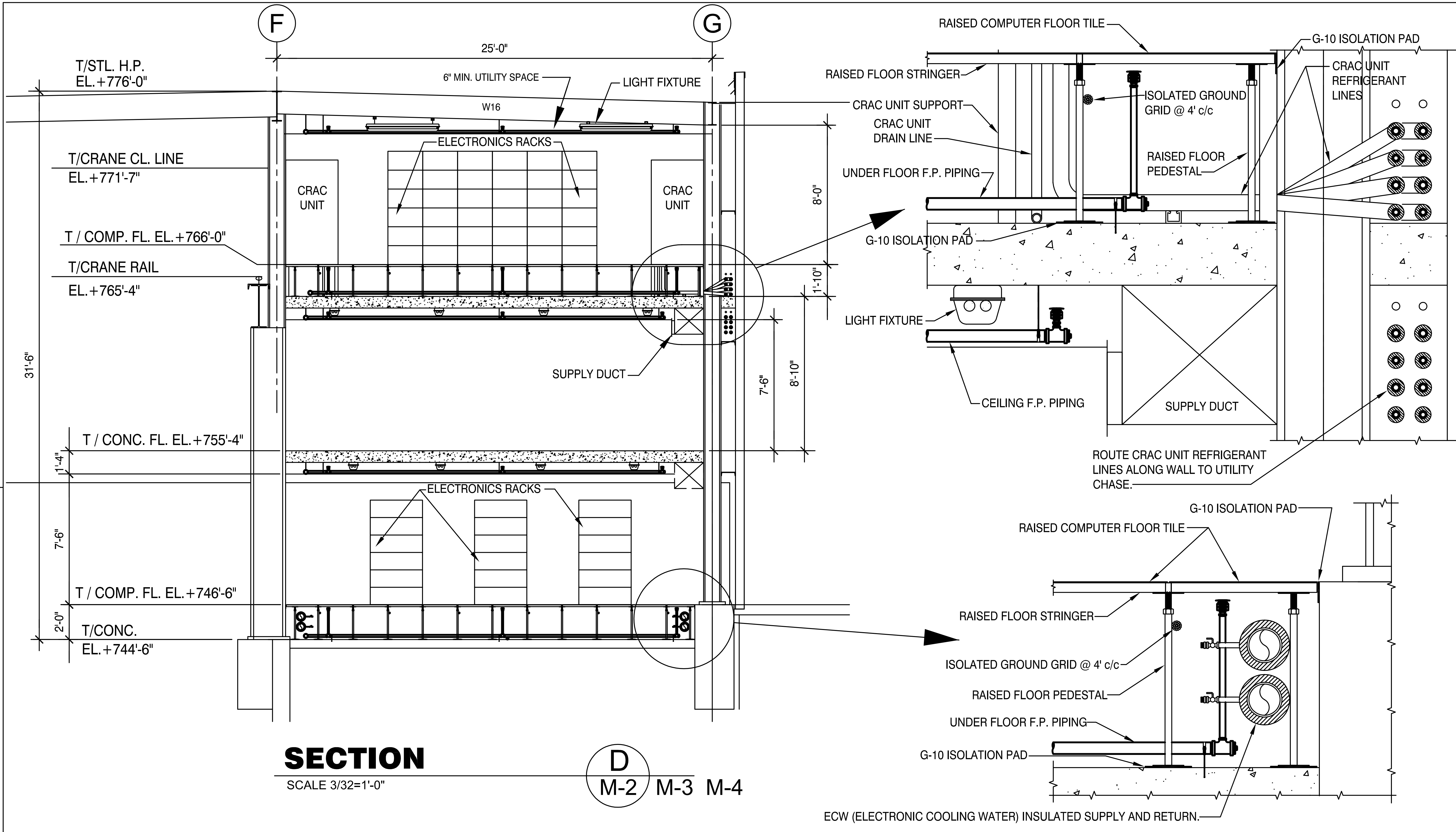
UNITED STATES DEPARTMENT OF ENERGY

C-O OUTFITTING

MECHANICAL - PLAN AT EL. 766'-0"

DRAWING NO. **6-8-3** **CD-1 REVIEW** **M-4** REV.

APRIL 2004



REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE: 1/8"=1'-0"

8 0 8 16
SCALE FEET

FERMI NATIONAL ACCELERATOR LABORATORY

UNITED STATES DEPARTMENT OF ENERGY

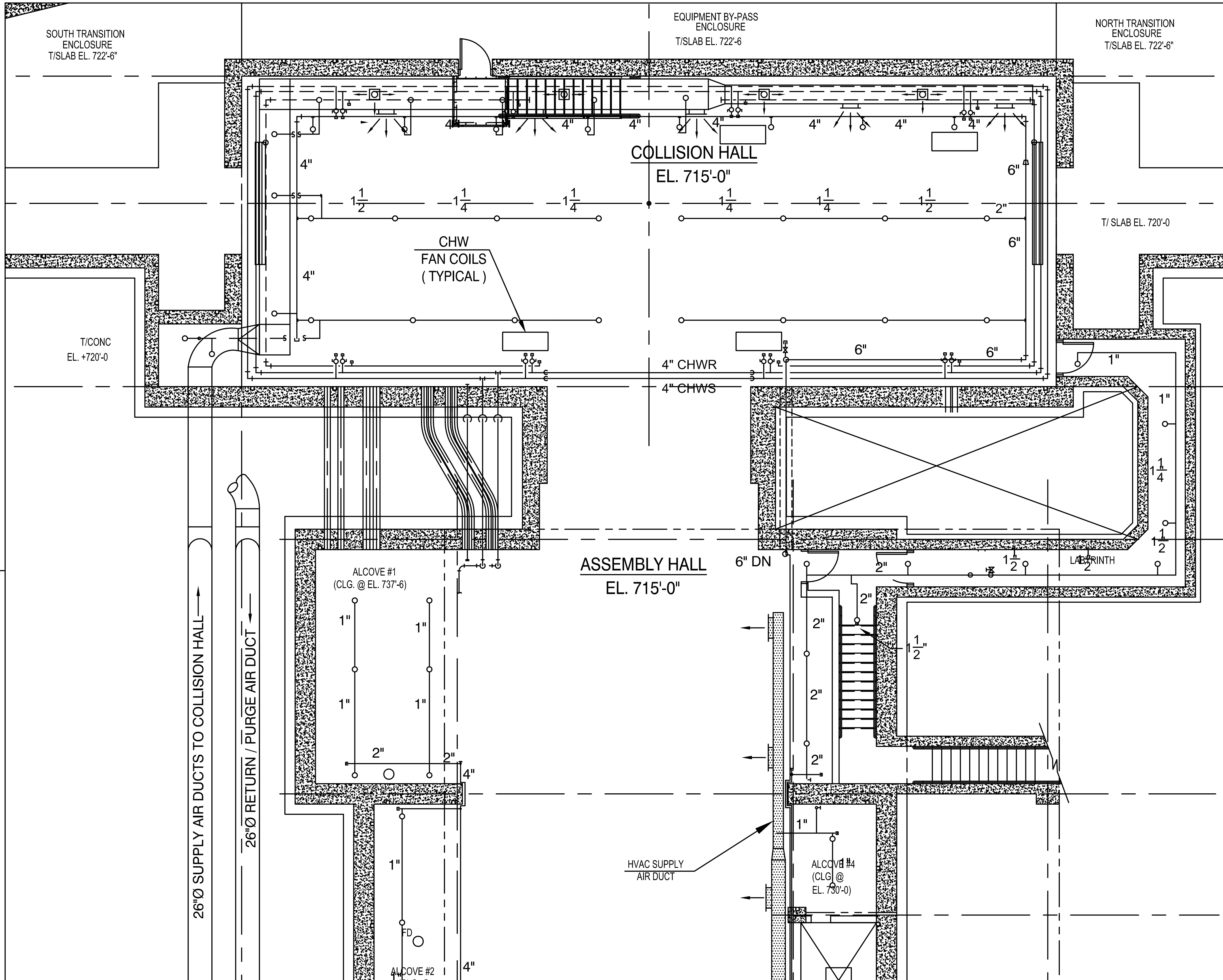
C-O OUTFITTING

MECHANICAL BUILDING SECTIONS - SHT. 1

DRAWING NO. **6-8-3** **CD-1 REVIEW** **M-5** REV.

APRIL 2004

Dwg: 6-8-B-TeV-CDR.dwg Plotted: 18DEC03 @ 07:47:14a.m.



COLLISION HALL

MECHANICAL HVAC CRITERIA

I. NORMAL HVAC MODE

ENVIRONMENT--------------- HVAC
TEMPERATURE -------------- 60° F to 80° F
HUMIDITY----------------------- 40% to 50% RH
53° F DEWPOINT
MAKEUP AIR------------------- NO LESS THAN 50 CFM
EQUIP. LOAD TO AIR ------ ~ 37 KW

II. ODH PURGE MODE

ENVIRONMENT--------------- HV
TEMPERATURE -------------- ABOVE FREEZING
HUMIDITY----------------------- NONE
ODH CFM----------------------- 5000 CFM

ASSEMBLY HALL

MECHANICAL HVAC CRITERIA

I. NORMAL HVAC MODE

ENVIRONMENT--------------- HVAC
TEMPERATURE -------------- 60° F to 80° F
HUMIDITY----------------------- 40% to 50% RH
MAKEUP AIR------------------- NO LESS THAN 50 CFM
EQUIP. LOAD TO AIR ------ ~ 4 KW

II. ODH PURGE MODE

ENVIRONMENT--------------- HV
TEMPERATURE -------------- ABOVE FREEZING
HUMIDITY----------------------- NONE
ODH CFM----------------------- 5000 CFM

COLLISION HALL & ASSEMBLY HALL

FIRE PROTECTION CRITERIA

- NEW PREACTION AUTOMATIC SPRINKLER RISER CONNECTED TO EXISTING PIPING PROTECTING HALL.
- PROVIDE AIR SAMPLING DETECTION AND SYSTEM PER NFPA-72.

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE: 3/32"=1'-0"

SCALE 4 0 4 8 12 16 20 24 28 FEET

PROJECT NORTH

FERMI NATIONAL ACCELERATOR LABORATORY

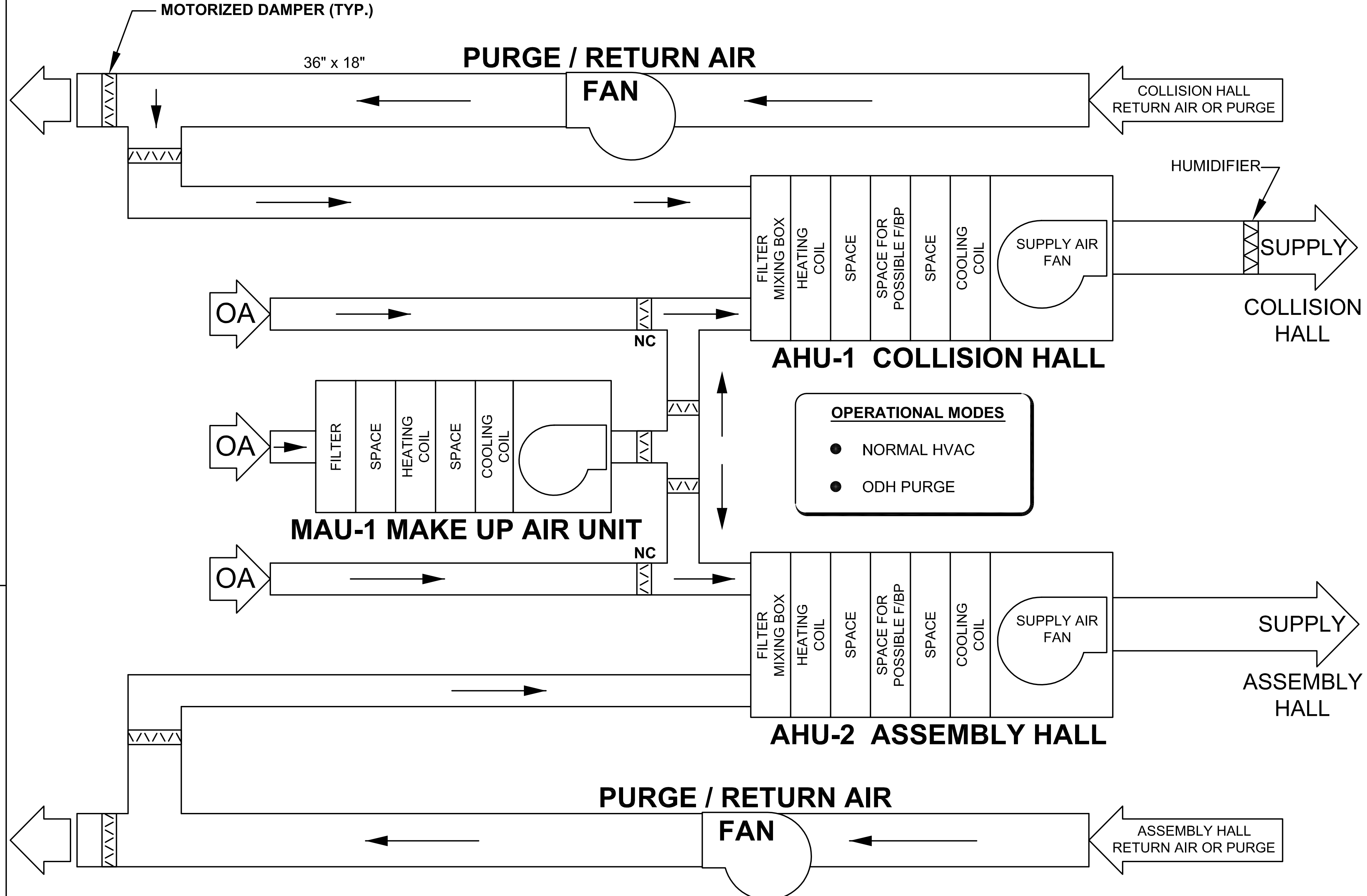
UNITED STATES DEPARTMENT OF ENERGY

C-O OUTFITTING

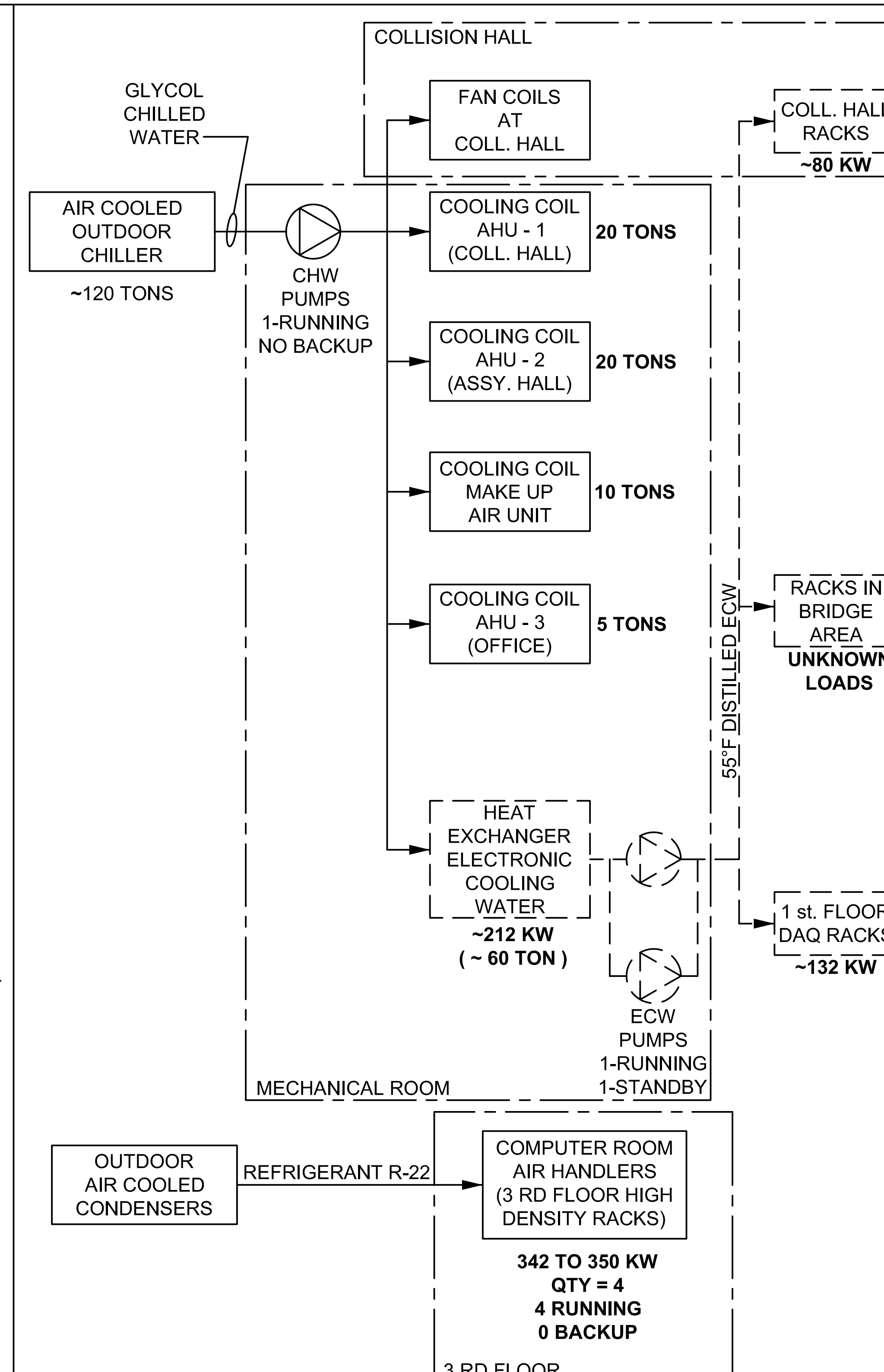
MECHANICAL - PLAN AT EL. 715'-0"

DRAWING NO. **6-8-3** **CD-1 REVIEW** **M-6** REV.

APRIL 2004



HVAC SCHEMATIC



CHW BLOCK DIAGRAM

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE:

FERMI NATIONAL ACCELERATOR LABORATORY

UNITED STATES DEPARTMENT OF ENERGY

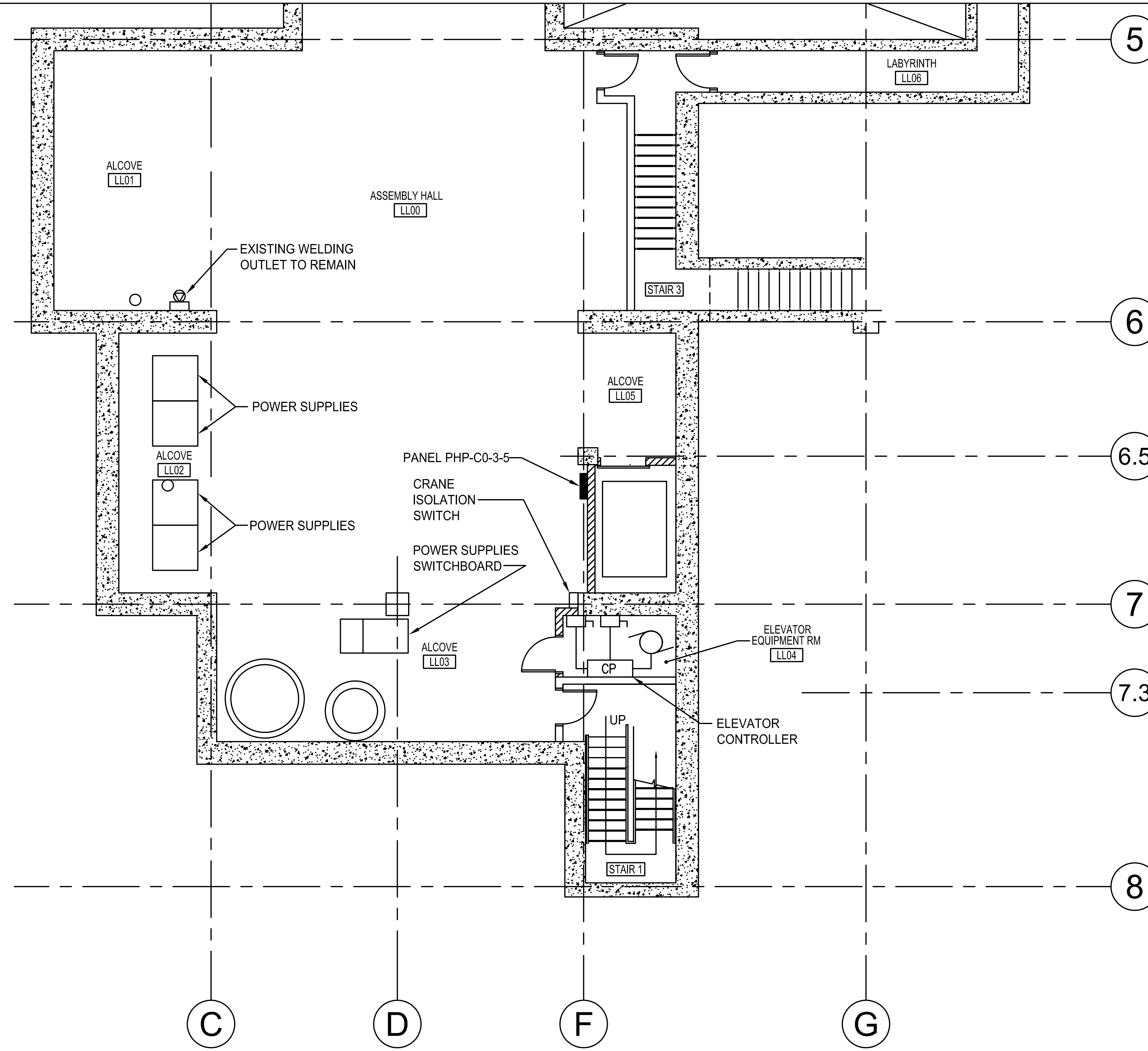
C-O OUTFITTING

MECHANICAL - HVAC

DRAWING NO. **6-8-3** **CD-1 REVIEW** **M-7** REV.

APRIL 2004

Dwg: 6-8-B-TeV-CDR.dwg Plotted: 18DEC03 @ 07:47:14a.m.

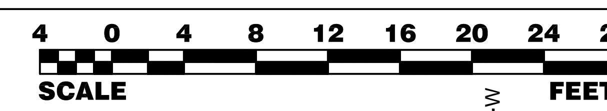


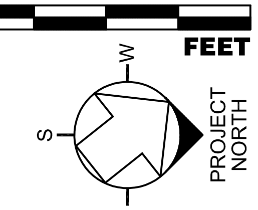
ELEVATION 715'-0"

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE: 3/32"=1'-0"





FERMI NATIONAL ACCELERATOR LABORATORY

UNITED STATES DEPARTMENT OF ENERGY

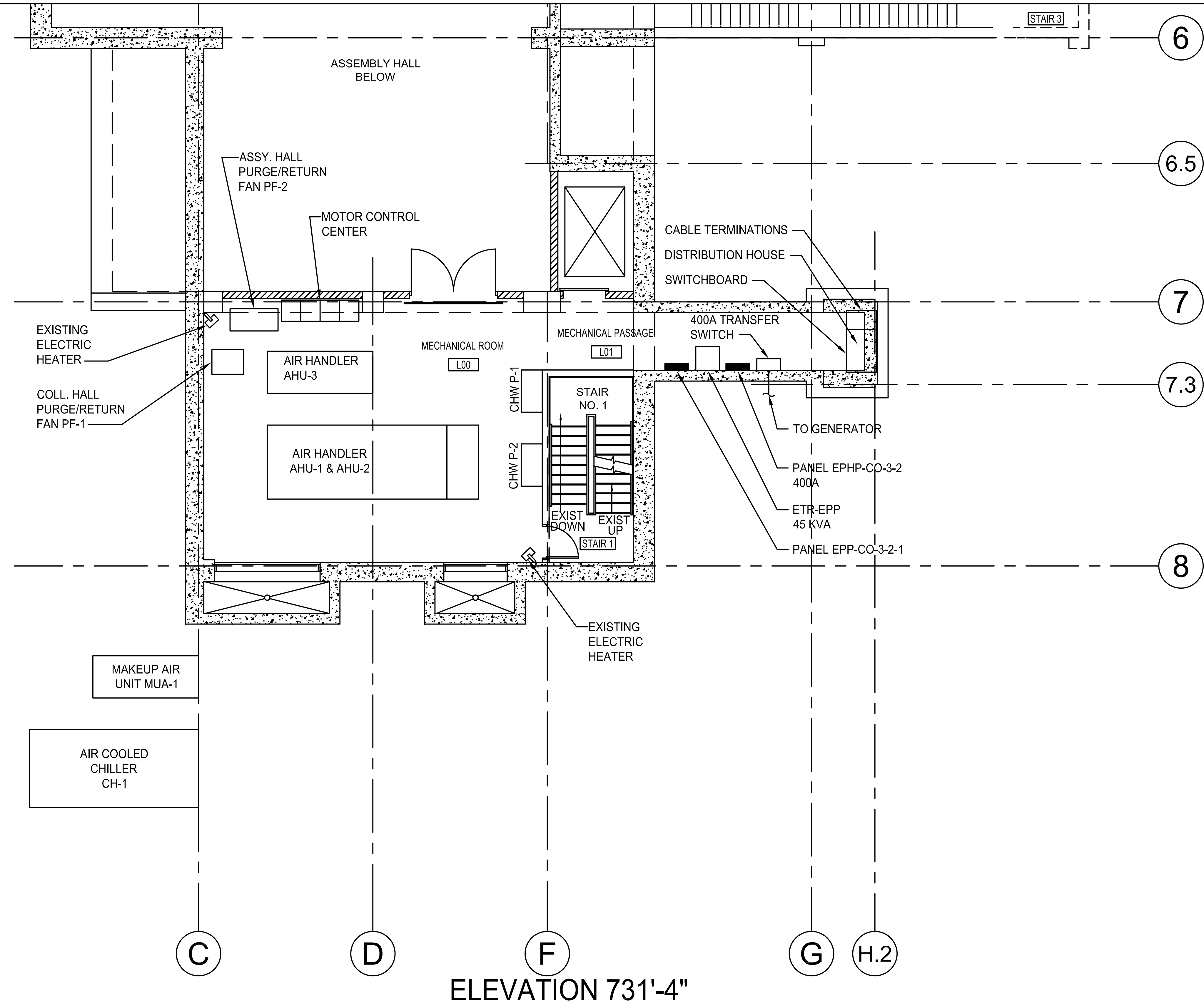
C-O OUTFITTING

ELECTRICAL - PLAN AT 715'-0"

DRAWING NO. **6-8-3** **CD-1 REVIEW** **E-1** REV.

APRIL 2004

Dwg: E1-6-8-B-TeV-CDR.dwg Plotted: 18MAR04 @ 04:34:35p.m.

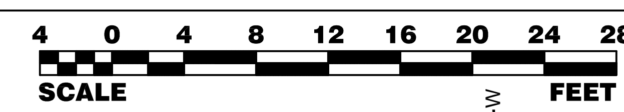


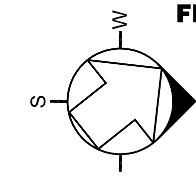
ELEVATION 731'-4"

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE: 3/32"=1'-0"





FERMI NATIONAL ACCELERATOR LABORATORY

UNITED STATES DEPARTMENT OF ENERGY

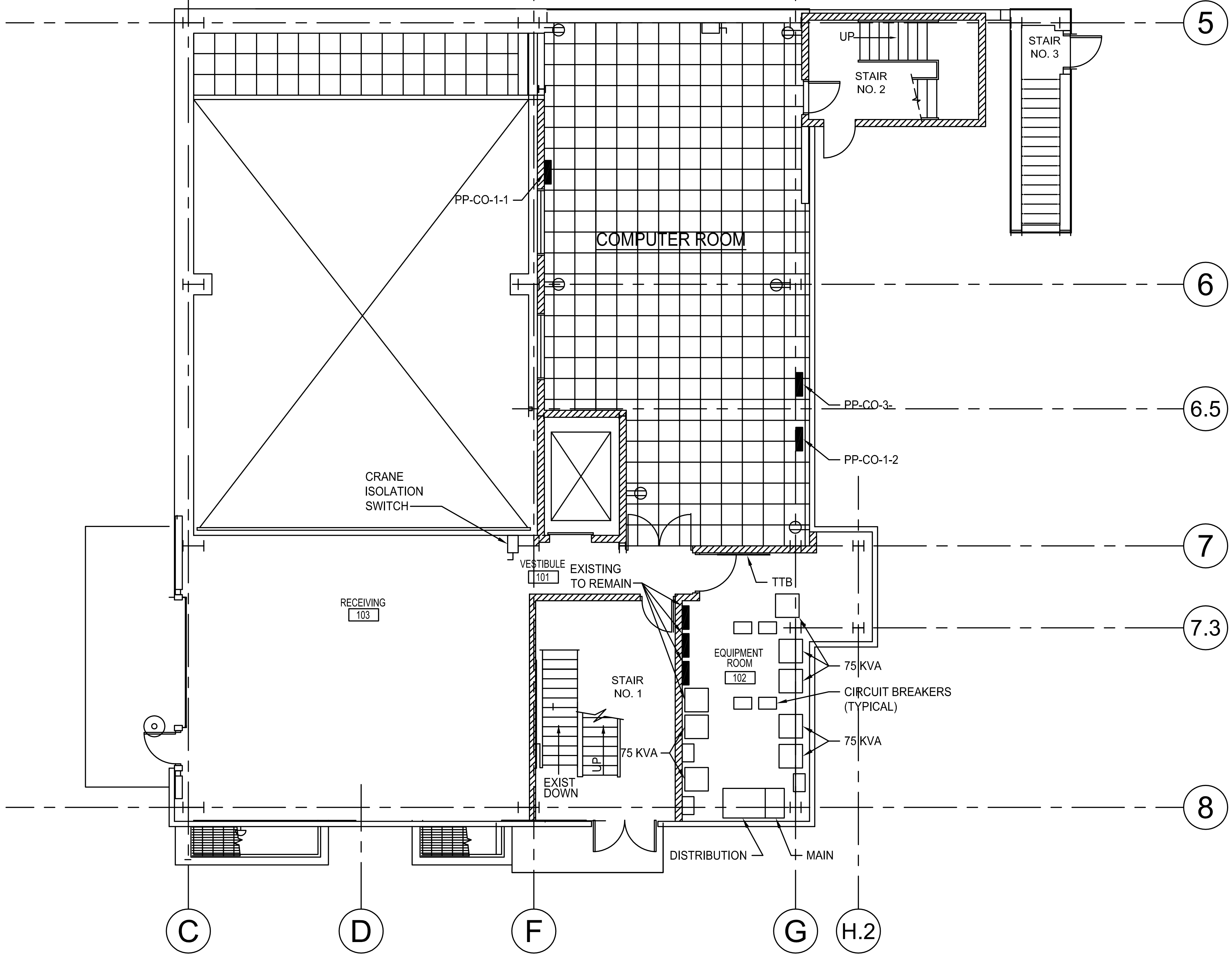
C-O OUTFITTING

ELECTRICAL - PLAN AT 731'-4"

DRAWING NO. 6-8-3 CD-1 REVIEW E-2 REV.

APRIL 2004

Dwg: E2-6-8-B-TeV-CDR.dwg Plotted: 18MAR04 @ 04:36:13p.m.

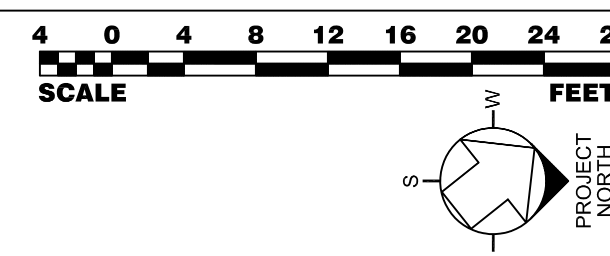


ELEVATION 746'-6" U.N.

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE: 3/32"=1'-0"



FERMI NATIONAL ACCELERATOR LABORATORY

UNITED STATES DEPARTMENT OF ENERGY

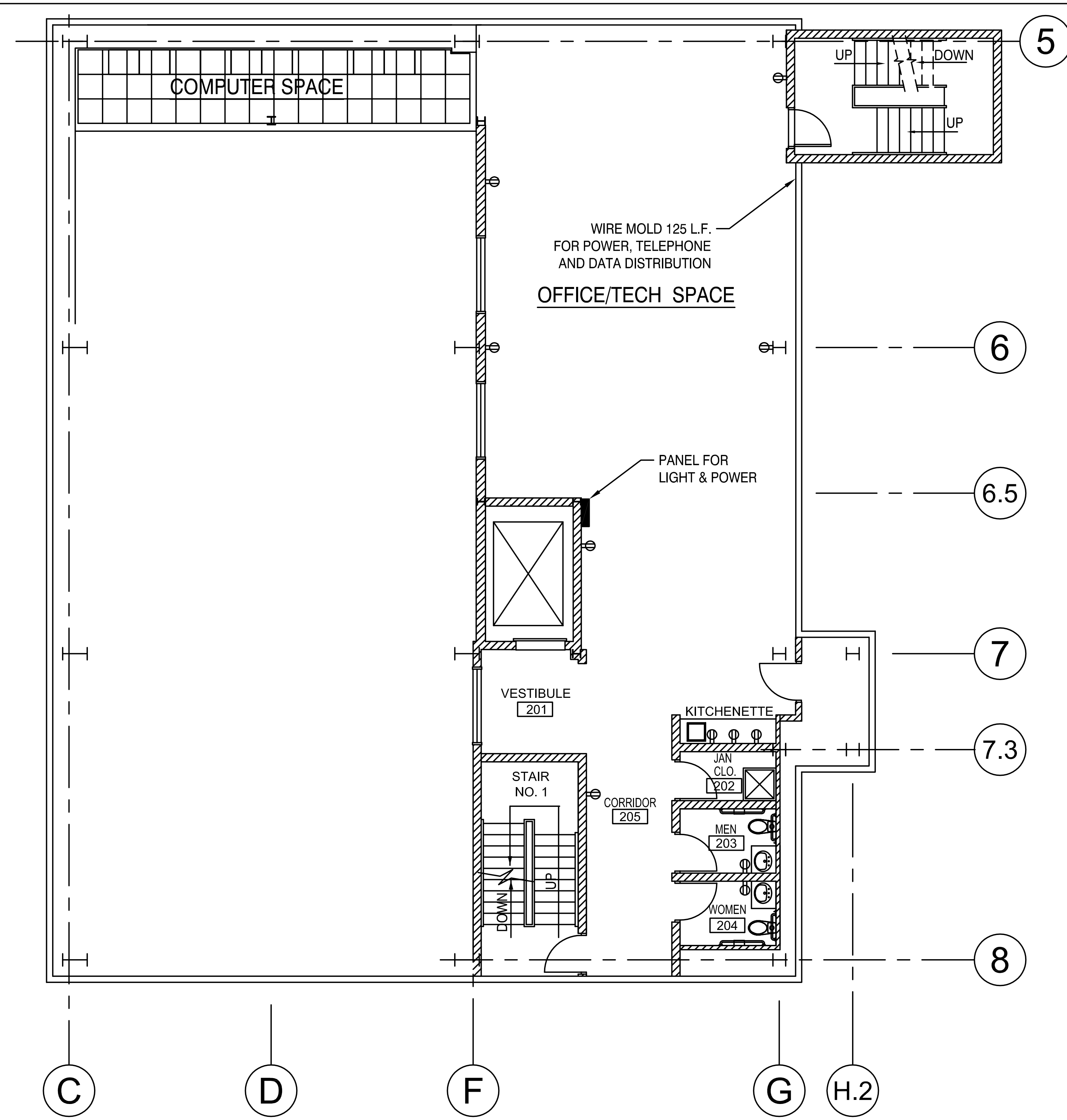
C-O OUTFITTING

ELECTRICAL - PLAN AT 746'-6"

DRAWING NO. **6-8-3** **CD-1 REVIEW** **E-3** REV.

APRIL 2004

Dwg: E3-6-8-B-TeV-CDR.dwg Plotted: 23MAR04 @ 01:50:35p.m.



T/CONC. ELEVATION 755'-4"

REV.	DATE	DESCRIPTIONS

REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE: 3/32"=1'-0"

4 0 4 8 12 16 20 24 28
SCALE FEET

PROJECT NORTH

W S E

FERMI NATIONAL ACCELERATOR LABORATORY

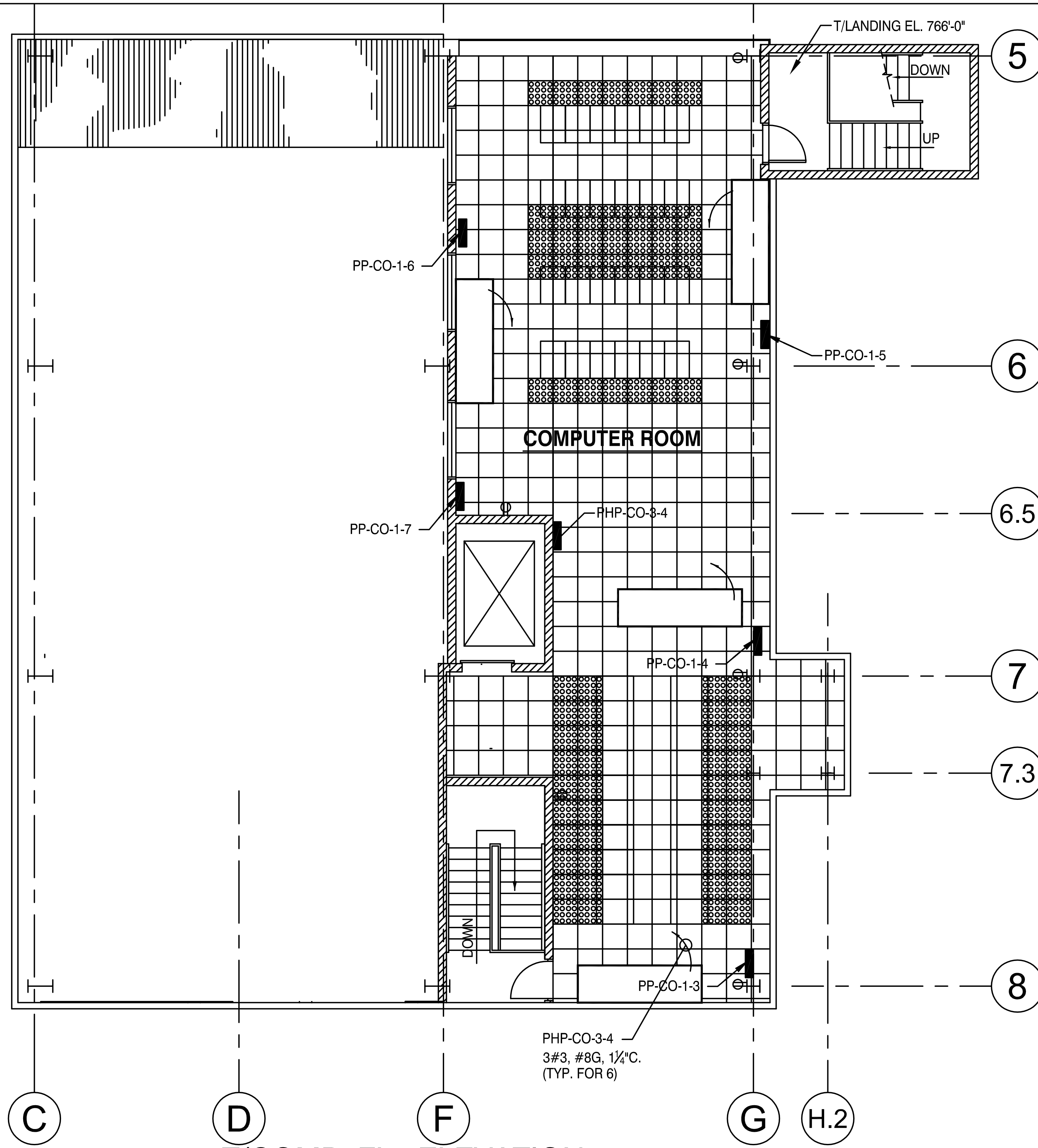
UNITED STATES DEPARTMENT OF ENERGY

C-O OUTFITTING

ELECTRICAL - PLAN AT EL. 755'-4"

DRAWING NO. **6-8-3** **CD-1 REVIEW** **E-4** REV.

APRIL 2004



T/COMP. FL. ELEVATION 766'-0"

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE: 3/32"=1'-0"

SCALE 4 0 4 8 12 16 20 24 28 FEET

W S E PROJECT NORTH

FERMI NATIONAL ACCELERATOR LABORATORY

UNITED STATES DEPARTMENT OF ENERGY

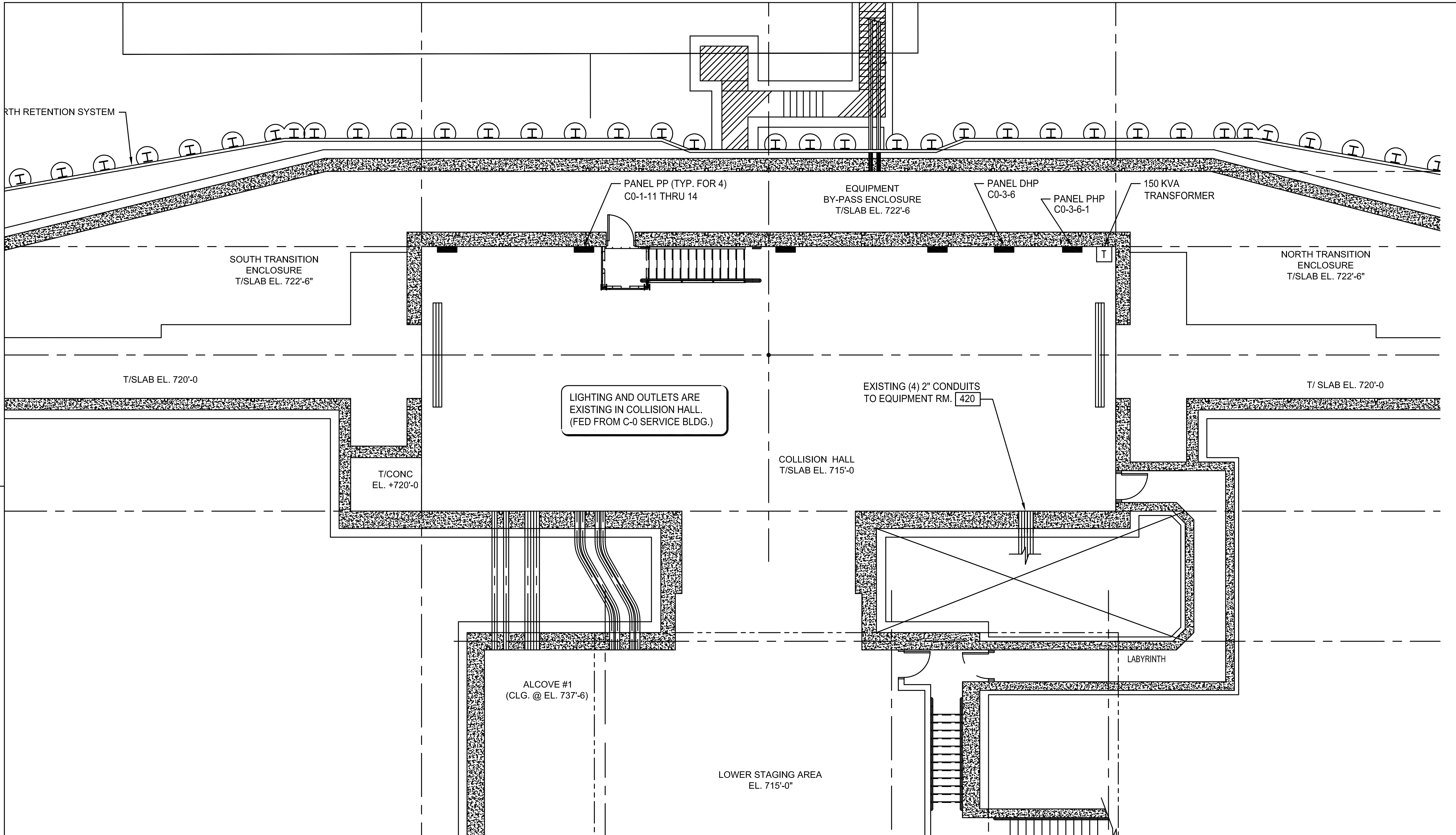
C-O OUTFITTING

ELECTRICAL - PLAN AT EL. 766'-0"

DRAWING NO. **6-8-3** **CD-1 REVIEW** **E-5** REV.

APRIL 2004

Dwg: E5-6-8-B-TeV-CDR.dwg Plotted: 23MAR04 @ 01:52:25p.m.



SCALE: 3/32"=1'-0"

4 0 4 8 12 16 20 24 28
SCALE FEET

S W E
PROJECT NORTH

		NAME	DATE
		DESIGNED		
		DRAWN		
		CHECKED		
		APPROVED		
REV.	DATE	DESCRIPTIONS	SUBMITTED	
		REVISIONS		

FERMI NATIONAL ACCELERATOR LABORATORY

UNITED STATES DEPARTMENT OF ENERGY

C-0 OUTFITTING

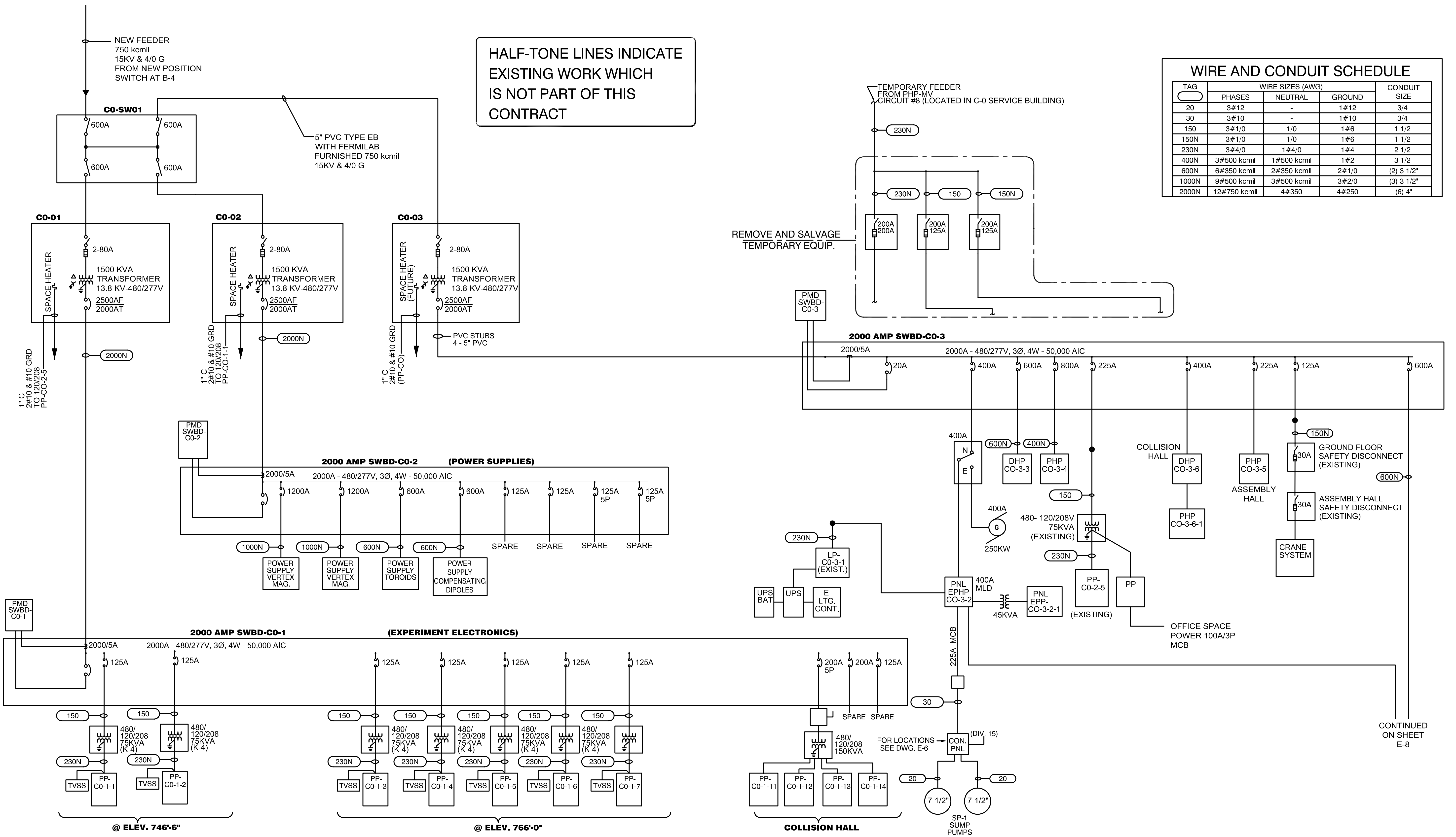
ELECTRICAL - PLAN AT EL. 715'-0"

DRAWING NO. **6-8-3** **CD-1 REVIEW** **E-6** REV.

APRIL 2004

Dwg: E6-6-8-B-TeV-CDR.dwg Plotted: 23MAR04 @ 01:53:24p.m.

Dwg: E7-6-8-B-TeV-CDR.dwg Plotted: 18MAR04 @ 04:58:58p.m.



WIRE AND CONDUIT SCHEDULE

TAG	WIRE SIZES (AWG) PHASES	NEUTRAL	GROUND	CONDUIT SIZE
20	3#12	-	1#12	3/4"
30	3#10	-	1#10	3/4"
150	3#1/0	1/0	1#6	1 1/2"
150N	3#1/0	1/0	1#6	1 1/2"
230N	3#4/0	1#4/0	1#4	2 1/2"
400N	3#500 kcmil	1#500 kcmil	1#2	3 1/2"
600N	6#350 kcmil	2#350 kcmil	2#1/0	(2) 3 1/2"
1000N	9#500 kcmil	3#500 kcmil	3#2/0	(3) 3 1/2"
2000N	12#750 kcmil	4#350	4#250	(6) 4"

REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE:

FERMI NATIONAL ACCELERATOR LABORATORY

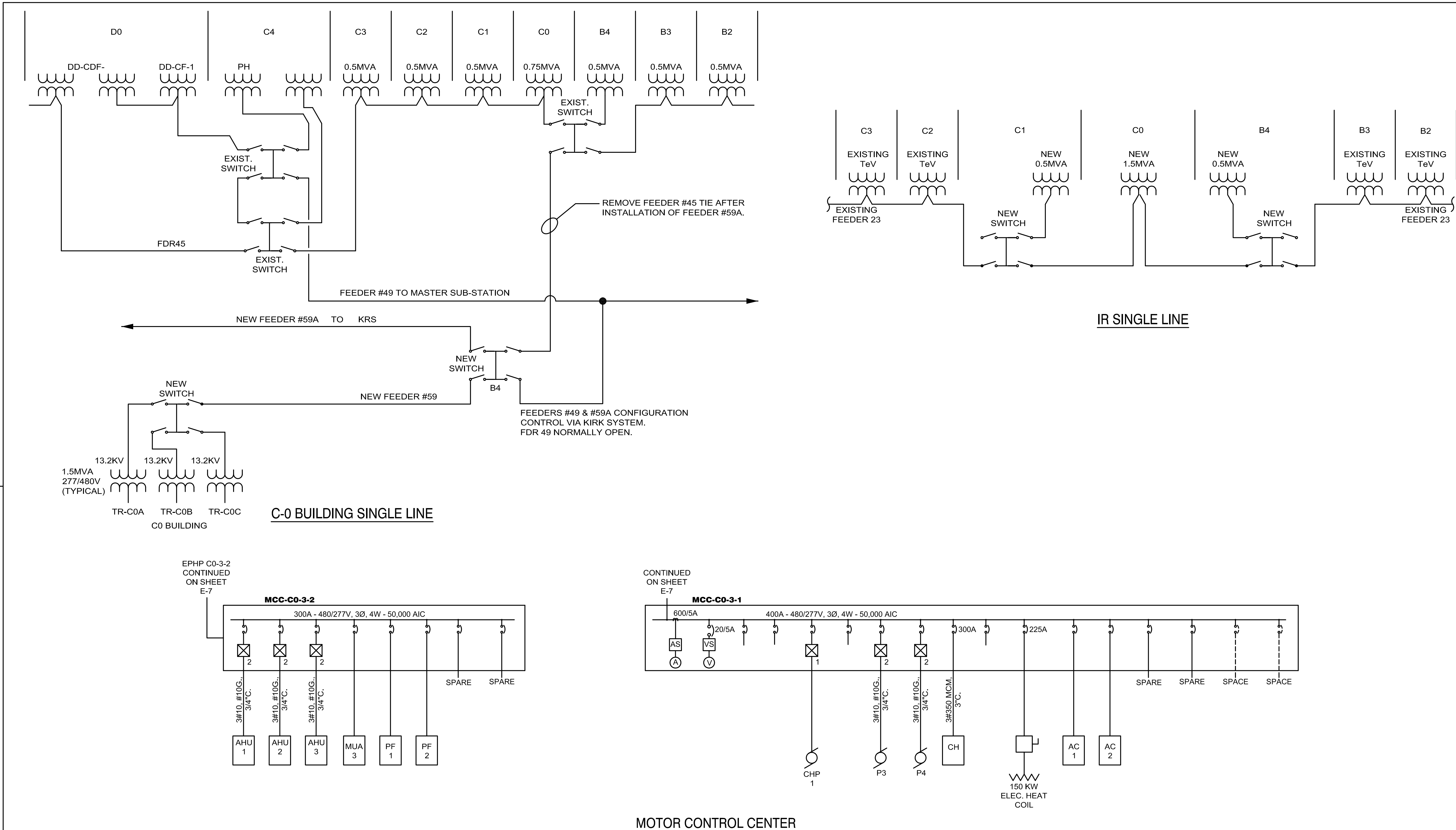
UNITED STATES DEPARTMENT OF ENERGY

C-O OUTFITTING

ELECTRICAL ONE-LINE DIAGRAM

DRAWING NO. **6-8-3** **CD-1 REVIEW** **E-7** REV.

APRIL 2004



REV.	DATE	DESCRIPTIONS
		REVISIONS

	NAME	DATE
DESIGNED		
DRAWN		
CHECKED		
APPROVED		
SUBMITTED		

SCALE:

FERMI NATIONAL ACCELERATOR LABORATORY

UNITED STATES DEPARTMENT OF ENERGY

C-O OUTFITTING

ELECTRICAL ONE-LINE DIAGRAM

DRAWING NO. **6-8-3** **CD-1 REVIEW** **E-8** REV.

APRIL 2004

Dwg: E8-6-8-B-TeV-CDR.dwg Plotted: 23MAR04 @ 01:55:20p.m.

This appendix contains:

- Fermilab Environmental Evaluation Form
- Fermilab Engineering Standards Manual (not Included for this review)
- Applicable Directives and Work Smart Standards (not Included for this review)
- LEED Project Checklist
- Whitestone Building and Repair Cost Reference Information
- Stakeholder Input from Comment and Compliance Review

NEPA PIF

Project/Activity Title BTeV Conventional Construction
Project Number 8-6-3
Project Initiator Joel Butler X3148
D/S Initiating Activity PARTICLE PHYSICS DIVISION OFFICE
Type Funding GPP/AIP
Total Estimated Cost 6600000

JUSTIFICATION FOR THE PROJECT

Describe the **purpose and/or need** for the project.

This project would supply infrastructure and utilities necessary to utilize the C-0 Test Area Building, completed in 1998 (Project # 8-6-2), for planned high energy physics experiments.

What are the reasonable alternatives to this project and why were they rejected? (Reasonable alternatives include the following: utilization of a different approach, process, or methodology; conducting the activity at an alternative location; or doing nothing. If inaction would prevent the fulfillment of a purpose and/or need then state this and explain.

There are no feasible alternatives to the proposed project that would accomplish the purpose and need.

DESCRIPTION OF THE PROPOSED ACTION

Provide a **narrative description** of the activity/project. The description shall focus only on physical actions to be undertaken, such as digging, trenching, demolishing, building, etc. **Theoretical or engineering explanations ARE NOT RELEVANT to this analysis**. The type (s) of equipment to be used shall be included where applicable. Indicate the estimated schedule of the action. If this is new construction, *show the location of the project on an attached site map and provide a specific area map showing the limits of the project.*

This project would involve the construction of utility corridors and pads, parking lots, hardstands and two small support structures. Utilities would be trenched in from the Main Ring Road to new 1500 KVA transformers at the B-4, C-0, and C-1 service buildings. A ~700 foot long 13.8 KV feeder, including a manhole, would be run from the B-4 service building to the C-0 Test Area Building. A new 13.8 KVA feeder would be pulled through existing ducts from the Kautz Road substation to the Main Ring Road utilities. Three transformers, an emergency generator, two chillers and two condensers would be placed on new pads in the vicinity of the C-0 Test Area Building. A small gas shed and a service building would be constructed on shallow footers. New hardstand would be constructed to accomodate the support buildings and staging areas. The existing maintenance road would be extended ~200 ft. to intersect E Road, and the existing hardstand parking lot and service drive would be paved.

Describe the **magnitude of the project**. Provide as much quantitative information as possible relevant to the overall impact of the project on the environment. (For example, what is the area of a new building, length of utility lines to be installed, the volume of soil to be excavated, volume and character of effluent(s), magnitude of radioactivity, etc.)

All excavation would be minor in nature. Shallow footers would require <100 cu. yd. of excess spoil. Excavations for the feeder lines will generate little or no spoils, because soil will be used for backfilling. Any excess suitable soils would be taken to a stockpile on site. Non-suitable materials would be taken off site for disposal. The area of the gas shed would be ~150 sq. ft., and the new service building ~750 sq. ft. The extension of the maintenance road would require ~1200 sq. ft. of new paving. New hardstands would be ~6000 sq. ft.

POTENTIAL ENVIRONMENTAL EFFECTS

Please check items that apply. **Include a detailed explanation of all items checked.**

Will the proposed action change or cause disturbance to the following resources?

Will the proposed action involve any of the following regulated substances or activities?

- Clearing or Excavation (The following information will also be needed on the PIF: the estimated area to be affected, the volume of spoils, the expected disposition of spoils, and the soil erosion control measures to be utilized.)
- Chemical use or storage (If the action involves excavation, determine whether the location was ever used for chemical dispensing, was a waste or product storage area, or has been the site of any chemical spills. Also, find out if the proposed location is near one of Fermilab's 5 RCRA Solid Waste Management Units.)
- Radiation exposures or radioactive air emissions

Other relevant disclosures

Comments
Excavation -- see magnitude section above.
Chemical Storage -- standard gases (nitrogen, helium, ethane/argon) would be stored in the gas shed. None of the gases are flammable.
Radiation exposure -- a porion of the work would be accomplished in a controlled area. All workers in this area will be required to have had Rad Worker training. No radioactive air emissions are anticipated.

FAO
Cooper/mb
12/23/03

FAO
Lutha
12/ /03

FAO
Miller
12/ 23 /03

FAO
Monhart
12/ 23 /03

DEC 23 2003

Mr. Gerald Brown, Associate
Director for Operations Support
Fermilab
P.O. Box 500
Batavia, IL 60510

Dear Mr. Brown:

SUBJECT: NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) DETERMINATION AT FERMI NATIONAL ACCELERATOR LABORATORY - "BTeV PROJECT"

Reference: Letter, G. Brown to J. Monhart, dated December 12, 2003, Subject: Same As Above

I have reviewed the Fermilab Environmental Evaluation Notification Form (EENF) for the subject proposed project transmitted by your referenced letter. Based on the information provided in the EENF, I have approved the following project as a categorical exclusion (CX):

Project Name	Approved	CX (s)
BTeV Project	12/23/2003	B1.15, B3.10

I am returning a signed copy of the EENF for your records. No further NEPA review is required. This project falls under a categorical exclusion(s) provided in 10 CFR 1021, as amended in 1996.

Sincerely,
Original signed by
Jane L. Monhart
Area Manager

Jane L. Monhart
Area Manager

Enclosure:
Signed EENF

cc: M. Witherell, w/o encl.
K. Stanfield, w/o encl.
B. Chrisman, w/o encl.
C. Trimby, w/o encl.
cc: J. Butler, PPD, w/encl.
B. Griffing, ESHS, w/encl.
T. Dykhuis, ESHS, w/o encl.
bc: P. Siebach, TS-STS, w/encl.
V. Prouty, OCC-GL, w/o encl.

S:CX-BTeV.12-03.jc

File: ENV-7

FERMILAB ENVIRONMENTAL EVALUATION NOTIFICATION FORM

Project/Activity Title: BTeV Project
ES&H Tracking Number: 01038 **Funding Source:** Major Item of Equipment
Fermilab Project Manager: Joel Butler

Signature Joel Butler

Date Dec. 12, 2003

Fermilab NEPA Reviewer: Teri Dykhuis

Signature Teri L. Dykhuis

Date 12/12/03

I. Description of the Proposed Action

The proposed BTeV Project would include building and installing a new detector in the C-Zero Hall of the Tevatron Collider. The BTeV project would consist of three subprojects: the BTeV Detector, Interaction Region, and the C-Zero Outfitting.

The BTeV Detector would consist of a large analysis dipole magnet; a silicon pixel vertex detector; a forward tracker consisting of silicon microstrip detectors close to the beams and straw tube chambers far from the beam; a Ring Imaging Cherenkov counter (RICH) for particle identification; an electromagnetic calorimeter to reconstruct photons and measure their momenta and angles; and a muon detector. The BTeV Detector would also include a state of the art trigger system that can analyze every beam crossing of the Tevatron and select events with evidence of particles containing *b*-quarks that decay downstream of the main interaction vertex and a high speed high capacity data acquisition system capable of recording all events containing these b-quarks.

The Interaction Region subproject will modify the accelerator to produce high luminosity at the C-Zero interaction region.

The C-Zero Outfitting subproject would supply infrastructure and utilities necessary to utilize the C-0 Test Area Building, which was completed in 1998 (Project # 8-6-2), for planned high energy physics experiments.

This subproject would involve the construction of utility corridors and pads, parking lots, hardstands and two small support structures. Utilities would be trenched in from the Main Ring Road to new 1500 KVA transformers at the B-4, C-Zero, and C-One service buildings. An approximate 700 feet long 13.8 KV feeder, including a manhole, would be run from the B-Four service building to the C-Zero Test Area Building. A new 13.8 KVA feeder would be pulled through existing ducts from the Kautz Road substation to the Main Ring Road utilities. Three transformers, an emergency generator, two chillers and two condensers would be placed on new pads in the vicinity of the C-Zero Test Area Building. A small gas shed and a service building would be constructed on shallow footers. New hardstand would be constructed to accommodate the support buildings and staging areas. The existing maintenance road would be extended approximately 200 feet to intersect E Road, and the existing hardstand parking lot and service drive would be paved. In addition, internal modifications would be made to the C-Zero Test Area Building to accommodate the BTeV experiment.

There are no feasible alternatives to the proposed project that would accomplish the purpose and need.

II. Description of the Affected Environment

All excavation would be minor in nature. Shallow footers would require less than 100 cubic yards of excess spoil. Excavations for the feeder lines will generate little or no spoils, because soil will be used for backfilling. Any excess suitable soils would be taken to a stockpile on site. Non-suitable materials would be taken off site for disposal. The area of the gas shed would be approximately 150 square feet, and the new service building would be approximately 750 square feet. The extension of the maintenance road would require approximately 1200 square feet of new paving. New hardstands would be approximately 6000 square feet.

III. Potential Environmental Effects (Provide comments for each checked item and where clarification is necessary.)

A. Sensitive Resources: Will the proposed action result in changes and/or disturbances to any of the following resources?

- ☐ Threatened or endangered species
- ☐ Other protected species
- ☐ Wetland/Floodplains
- ☐ Archaeological or historical resources
- ☐ Non-attainment areas

B. Regulated Substances/Activities: Will the proposed action involve any of the following regulated substances or activities?

- ☒ Clearing or Excavation
- ☐ Demolition or decommissioning
- ☐ Asbestos removal
- ☐ PCBs
- ☐ Chemical use or storage
- ☐ Pesticides
- ☐ Air emissions
- ☐ Liquid effluents
- ☐ Underground storage tanks
- ☐ Hazardous or other regulated waste (including radioactive or mixed)
- ☒ Radioactive exposures or radioactive air emissions
- ☐ Radioactivation of soil or groundwater

C. Other relevant Disclosures

- ☐ Threatened violation of ES&H permit requirements
- ☐ Siting/construction/major modification of waste recovery or TSD facilities
- ☐ Disturbance of pre-existing contamination
- ☐ New or modified permits
- ☐ Public controversy
- ☐ Action/involvement of another federal agency
- ☐ Public utilities/services
- ☐ Depletion of a non-renewable resource

IV. NEPA Recommendation

Fermilab has reviewed this proposed action and concluded that the appropriate level of NEPA determination is a Categorical Exclusion. The conclusion is based on the proposed action meeting the applicable requirements in DOE's NEPA Implementation Procedures, 10 CFR 1021, Subpart D, Appendix B3.10 and B1.15.

V. DOE/CH-FAO NEPA Coordinator Review

Concurrence with the recommendation for determination:

NEPA Coordinator reviewer	Jonathan P.Cooper
Signature	Jonathan P. Cooper
Date	12/23/03
Fermi Area Manager	Jane L. Monhart
Signature	Jane L. Monhart
Date	12/23/03

VI. Comments on checked items in section III.

Excavation
See description of C-Zero Outfitting above.

Radiation exposure
A portion of the work would be accomplished in a controlled area. All workers in this area would be required to have received Radiation Worker training. No radioactive air emissions are anticipated.

LEED LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN

Project Checklist

Project

Yes	?	No		
1	1	12	**Sustainable Sites**	
Y			Prereq 1	**Erosion & Sedimentation Control**
x			Credit 1	**Site Selection**
		x	Credit 2	**Urban Redevelopment**
		x	Credit 3	**Brownfield Redevelopment**
		x	Credit 4.1	**Alternative Transportation**, Public Transportation Access
	x		Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms
		x	Credit 4.3	**Alternative Transportation**, Alternative Fuel Vehicles
		x	Credit 4.4	**Alternative Transportation**, Parking Capacity
		x	Credit 5.1	**Reduced Site Disturbance**, Protect or Restore Open Space
		x	Credit 5.2	**Reduced Site Disturbance**, Development Footprint
		x	Credit 6.1	**Stormwater Management**, Rate and Quantity
		x	Credit 6.2	**Stormwater Management**, Treatment
		x	Credit 7.1	**Landscape & Exterior Design to Reduce Heat Islands**, Non-Roof
		x	Credit 7.2	**Landscape & Exterior Design to Reduce Heat Islands**, Roof
		x	Credit 8	**Light Pollution Reduction**

Yes	?	No		
3		2	**Water Efficiency**	
x			Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%
x			Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation
		x	Credit 2	**Innovative Wastewater Technologies**
x			Credit 3.1	**Water Use Reduction**, 20% Reduction
		x	Credit 3.2	**Water Use Reduction**, 30% Reduction

Yes	?	No		
4		13	**Energy & Atmosphere**	
Y			Prereq 1	**Fundamental Building Systems Commissioning**
Y			Prereq 2	**Minimum Energy Performance**
Y			Prereq 3	**CFC Reduction in HVAC&R Equipment**
x			Credit 1	**Optimize Energy Performance**, 15% New / 5% Existing
x				**Optimize Energy Performance**, 20% New / 10% Existing
x				**Optimize Energy Performance**, 25% New / 15% Existing
		x		**Optimize Energy Performance**, 30% New / 20% Existing
		x		**Optimize Energy Performance**, 35% New / 25% Existing
		x		**Optimize Energy Performance**, 40% New / 30% Existing
		x		**Optimize Energy Performance**, 45% New / 35% Existing
		x		**Optimize Energy Performance**, 50% New / 40% Existing
		x		**Optimize Energy Performance**, 55% New / 45% Existing
		x		**Optimize Energy Performance**, 60% New / 50% Existing
		x	Credit 2.1	**Renewable Energy**, 5%
		x	Credit 2.2	**Renewable Energy**, 10%
		x	Credit 2.3	**Renewable Energy**, 20%

		x	Credit 3	**Additional Commissioning**
		x	Credit 4	**Ozone Depletion**
x			Credit 5	**Measurement & Verification**
		x	Credit 6	**Green Power**

Yes	?	No	
7		6	**Materials & Resources**

Yes	?	No		
Y			Prereq 1	**Storage & Collection of Recyclables**
x			Credit 1.1	**Building Reuse**, Maintain 75% of Existing Shell
x			Credit 1.2	**Building Reuse**, Maintain 100% of Shell
		x	Credit 1.3	**Building Reuse**, Maintain 100% Shell & 50% Non-Shell
x			Credit 2.1	**Construction Waste Management**, Divert 50%
		x	Credit 2.2	**Construction Waste Management**, Divert 75%
x			Credit 3.1	**Resource Reuse**, Specify 5%
		x	Credit 3.2	**Resource Reuse**, Specify 10%
x			Credit 4.1	**Recycled Content**, Specify 5% (p.c. + 1/2 p.i.)
x			Credit 4.2	**Recycled Content**, Specify 10% (p.c. + 1/2 p.i.)
x			Credit 5.1	**Local/Regional Materials**, 20% Manufactured Locally
		x	Credit 5.2	**Local/Regional Materials**, of 20% Above, 50% Harvested Locally
		x	Credit 6	**Rapidly Renewable Materials**
		x	Credit 7	**Certified Wood**

Yes	?	No	
8	1	6	**Indoor Environmental Quality**

Yes	?	No		
Y			Prereq 1	**Minimum IAQ Performance**
Y			Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**
		x	Credit 1	**Carbon Dioxide** (CO_2) **Monitoring**
x			Credit 2	**Ventilation Effectiveness**
x			Credit 3.1	**Construction IAQ Management Plan**, During Construction
x			Credit 3.2	**Construction IAQ Management Plan**, Before Occupancy
x			Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants
x			Credit 4.2	**Low-Emitting Materials**, Paints
	x		Credit 4.3	**Low-Emitting Materials**, Carpet
x			Credit 4.4	**Low-Emitting Materials**, Composite Wood
		x	Credit 5	**Indoor Chemical & Pollutant Source Control**
x			Credit 6.1	**Controllability of Systems**, Perimeter
x			Credit 6.2	**Controllability of Systems**, Non-Perimeter
		x	Credit 7.1	**Thermal Comfort**, Comply with ASHRAE 55-1992
		x	Credit 7.2	**Thermal Comfort**, Permanent Monitoring System
		x	Credit 8.1	**Daylight & Views**, Daylight 75% of Spaces
		x	Credit 8.2	**Daylight & Views**, Views for 90% of Spaces

Yes	?	No	
		5	**Innovation & Design Process**

Yes	?	No		
		x	Credit 1.1	**Innovation in Design**: Specific Title
		x	Credit 1.2	**Innovation in Design**: Specific Title
		x	Credit 1.3	**Innovation in Design**: Specific Title
		x	Credit 1.4	**Innovation in Design**: Specific Title
		x	Credit 2	**LEED™ Accredited Professional**

Yes	?	No	
23	2	44	**Project Totals**

Certified 26-32 points **Silver** 33-38 points **Gold** 39-51 points **Platinum** 52-69 points t Name: BTeV

14 Points
Required
1
1
1
1
1
1
1
1
1
1
1
1
1
1
5 Points
1
1
1
1
1
17 Points
Required
Required
Required
1
1
1
1
1
1
1
1
1
1
1
1
1

1
1
1
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13 Points
Required
1
1
1
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1
1
1
1
1
1
1
1
1

15 Points
Required
Required
1
1
1
1
1
1
1
1
1
1
1
1
1
1
1

5 Points
1
1
1
1
1

69 Points

2. Building M&R Cost Profiles

This chapter presents estimates of 50-year maintenance cost profiles for 50 building models. Each two-page profile includes a description of the model building, a list of major components, and forecasts of maintenance and repair (M&R) costs at various levels of aggregation. The profile estimates were made with the Whitestone MARS forecast system, calibrated for the Washington DC metropolitan area. The profiles can be adjusted for other metro areas using the Local Maintenance Cost Index shown in Chapter 3, and modified to include different components shown in Chapter 5.

Table 2-1
Summary of M&R Cost Profiles

Building Type	Gross Sqft.	Annual M&R Cost per Gsft.*	Annual M&R Cost as % of Repl. Value
Car Wash	800	$10.00	4.90%
Garage, Service Station	1,400	7.36	6.40
Apartments 1-3 story	22,500	6.53	6.64
Apartments 4-7 story	60,000	6.27	6.27
Motel	8,000	6.06	6.58
Fire Station	6,000	5.61	5.66
Restaurant, Fast Food	4,000	5.53	4.91
Bank	4,100	5.43	3.56
Telephone Exchange	5,000	5.12	4.92
Motel, 40 Unit	18,000	5.03	4.86
Laundromat	3,000	5.03	4.36
Restaurant, Large	10,000	4.99	4.17
Club, Country	6,000	4.81	3.69
Religious Education	10,000	4.77	4.53
Warehouse, Self-storage	24,000	4.45	7.18
Medical Clinic	13,000	4.17	2.51
Movie Theater	10,000	4.12	3.96
Store, Convenience	4,000	4.10	5.77
Community Center	10,000	4.09	4.34
Hospital, General	125,000	4.08	3.37
Hospital, Research	540,200	4.05	1.53
Dormitory, 50 Room	25,000	4.04	4.93
Bus Terminal	12,000	3.82	4.21
Store, Retail	8,000	3.80	5.14
Funeral Home	10,000	3.76	4.43
Town Hall, 1 Story	11,000	3.66	4.26
Church	17,000	3.60	3.20
Court House 1 Story	30,000	3.52	2.74
Post Office	13,000	3.51	4.28
Auditorium	24,000	3.48	3.34
Public Library, 3 Story	60,000	3.40	3.26
College Student Union	25,000	3.35	3.32
Apartments, 24 Story	220,000	3.17	4.11
Club, Social	22,000	3.15	3.41
Gymnasium	40,000	3.07	3.39
Hockey Rink	30,000	2.94	2.77
College Classroom	90,000	2.89	2.84
Elementary School	47,000	2.81	4.06
Childcare Center	12,000	2.71	2.43
Bowling Center	20,000	2.59	4.13
Garage, Auto Sales	21,000	2.56	3.78
County Jail	318,455	2.46	0.65
Light Manufacturing Plant	45,000	2.37	4.19
Office Park	65,000	2.27	4.92
Supermarket	96,000	2.20	3.25
Department Store	94,000	2.15	3.28
Office Building, 2 Story	83,000	2.04	2.29
Office Building, 15 Story	250,000	1.90	1.65
Aircraft Hangar	32,000	1.86	2.45
Warehouse, Large	80,000	1.80	4.02

*Average costs over 50-year lifetime, Washington DC metro area

From the cost analysts perspective, the most useful information in these profiles is probably the year-by-year total shown under the "Cost per Sqft. by System" section. A projection of M&R costs is required in the financial evaluation of virtually all large construction or renovation projects. Often this trend is estimated with a simple approximation (2 to 4 percent of replacement value is common) that obscures the actual oscillations in M&R requirements, and misstates costs when expressed in terms of present value. In comparison, Whitestone estimates are based on component life cycles that provide a more realistic and defensible projection of M&R costs.

For the purposes of the facility manager, average values for M&R costs may be more useful than detailed year-to-year estimates. Conversations about facility funding and budgeting usually dwell on average costs per square foot, or average costs as a percentage of replacement value. Among our building models, the highest average cost per gsft. was for the car wash ($10.00), while the warehouse model had the lowest average cost ($1.80).

The reader may note the rankings in order of cost are different when expressed in terms of replacement value. The highest average M&R cost from this perspective was for the self-storage warehouse—7.18 percent of replacement value—a result due primarily to a low estimated replacement cost of $62 per square foot. A complete list of replacement costs is shown in the Appendix. In general, we are wary of costs expressed in terms of replacement values because of the great variation in new construction costs and the difficulty of determining replacement costs for older buildings.

Profile estimates are sensitive to a variety of factors such as unscheduled maintenance rates, in-house shop rates, and types of utilization. These sensitivities are discussed in Chapter 6, Definitions and Methods.

Community Center

Gross Sqft:	10,000
Height ft.:	12
Exterior:	Brick Veneer
Floor Coverings:	Carpet/Vinyl Tile
HVAC:	Electric Cool, Gas Heat, Singlezone Unit
Occupancy:	600
Replacement Cost:	$942,102

50-Year M&R Cost Summary

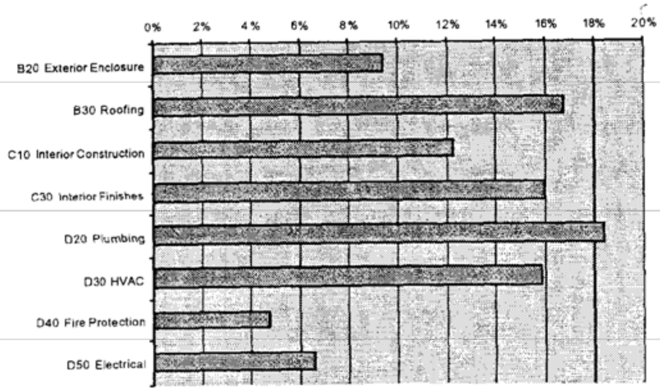
Cost ($2002)	50 Year Total	Annual Cost per Sqft.	Annual Cost as % Repl. Cost
PM & Minor Repair	$395,039	$0.79	0.84%
Unscheduled Maintenance	$454,055	$0.91	0.96%
Renewal & Replacement	$1,193,972	$2.39	2.53%
Total M&R Costs	$2,043,066	$4.09	4.34%

Components

Uniformat / Component	Quantity	Units
B20 Exterior Enclosure		
Clay Brick, Exterior, 1st Floor	4349	Sq Ft
Steel Frame, Painted, Operable Window, 12 sf, 1st Floor	3	Each
Aluminum Frame, Fully Glazed, Exterior Door	4	Each
B30 Roofing		
Concrete Steps	100	Sq Ft
Concrete Decking	400	Sq Ft
Built-up Roof	10000	Sq Ft
C10 Interior Construction		
Steel, Painted, Interior Door	72	Each
C30 Interior Finishes		
Sheetrock, Stippled, Interior Wall Finish	17160	Sq Ft
Vinyl Tile Flooring	5000	Sq Ft
Carpet, Nylon 20 oz., High Traffic	5000	Sq Ft
Acoustical Tile Ceiling	10000	Sq Ft
D20 Plumbing		
Tankless Water Closet	6	Each
Urinal, Vitreous China	2	Each
Lavatory, Vitreous China	7	Each
Sink, Stainless Steel	4	Each
Drinking Fountain, Refrigerated	3	Each
Pipe & Fittings, 3/4" Copper, Cold Water	0.79	K Ln Ft
Pipe & Fittings, 4" Steel	0.9	K Ln Ft
Pipe & Fittings, 2" Copper, Cold Water	0.935	K Ln Ft
Pipe & Fittings, 3/4" Copper, Hot Water	0.35	K Ln Ft
Pipe insulation, Cold Water	1.24	K Ln Ft
Pipe insulation, Hot Water	0.6	K Ln Ft
Water Heater, Gas/Oil 175 Gph	2	Each
Pipe & Fittings, 6" Cast Iron	0.43	K Ln Ft
Pipe & Fittings, 10" Cast Iron	0.2	K Ln Ft
Pipe & Fittings, 4" DWV PVC	0.145	K Ln Ft
Roof Drain, 2"	4	Each
Aluminum Gutter, Downspouts, Fittings	0.453	K Ln Ft
D30 HVAC		
Exhaust Fan, Ceiling, 200-500 Cfm	4	Each
Air Conditioner, Rooftop, 50 Ton	1	Each
D40 Fire Protection		
Fire Sprinkler System	1	Each
Fire Sprinkler Head	71	Each
D50 Electrical		
Safety Switch, Fused, 400 Amp., 3 Ph.	1	Each
Main Switchgear, <1200 Amp.	1	Each
Distribution Panel Board	2	Each
Emergency Horn & Strobe	5	Each
Exit Lighting Fixture, w/ Battery	4	Each
Incandescent Lighting Fixture, Basic, 100w	60	Each
Fluorescent Lighting Fixture, 160w	60	Each
Wiring Device, Switch	30	Each
Receptacle, 120V, 15 Amp	25	Each
TV Cable Outlet	1	Each
Annunciation Panel	1	Each
Fire Alarm Bell, 6"	4	Each
Fire Alarm Control Panel	1	Each
Manual Pull Station	4	Each
Smoke Detector	6	Each

***Use This Profile as a Template.** Adjust for other areas with the local cost index in Chapter 3. Substitute other components using the component data in Chapter 5.

Distribution of Repair Costs



Most Costly Repair Tasks

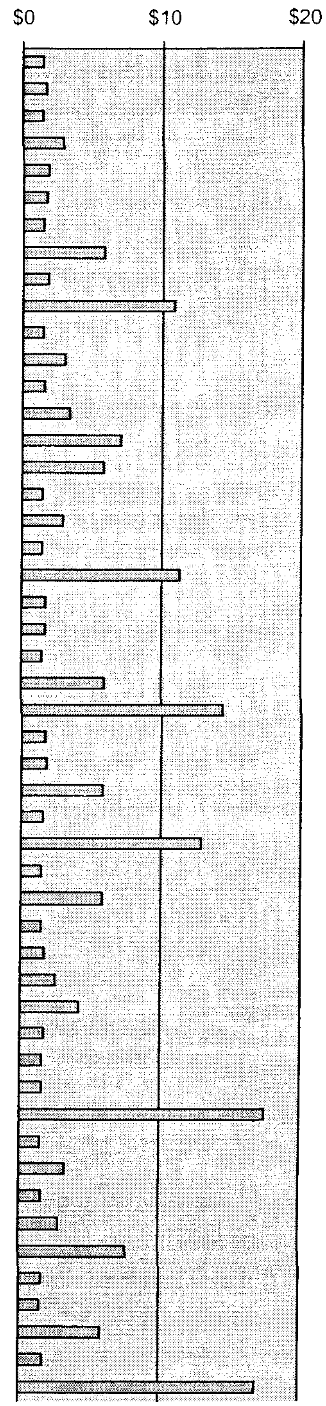
Major Repair Task	Task Cost*	Pct.**
Replace Air Conditioner, Rooftop, 50 Ton	15.22	9.6%
Refinish Sheetrock, Stippled, Interior Wall Finish	13.76	8.7%
Replace Carpet, Nylon 20 oz., High Traffic	13.47	8.5%
Maintain Built-up Roof	13.23	8.3%
Repair Air Conditioner, Rooftop, 50 Ton	9.33	5.9%
Replace Steel, Painted, Door Locks	8.82	5.6%
Fire Sprinkler System, Annual PM	7.64	4.8%
Clean & Reseal Clay Brick, Exterior, 1st Floor	5.88	3.7%
Replace Pipe & Fittings, 2" Copper, Cold Water	5.72	3.6%
Maintain Steel, Painted, Door Locks	5.49	3.5%
Replace Water Heater, Gas/Oil 175 Gph	4.68	2.9%
Replace Pipe & Fittings, 3/4" Copper, Cold Water	4.20	2.6%
Maintain Air Conditioner, Rooftop, 50 Ton	3.97	2.5%
Repoint (50% surface) Clay Brick, Exterior, 1st Floor	3.49	2.2%
Remove & Replace Membrane, Built-up Roof	3.33	2.1%
Place New Membrane Over Existing, Built-up Roof	3.31	2.1%
Replace Drinking Fountain, Refrigerated	2.27	1.4%
Replace Vinyl Tile Flooring	1.97	1.2%
Replace Pipe & Fittings, 3/4" Copper, Hot Water	1.86	1.2%
Clean Water Heater, Gas/Oil 175 Gph	1.72	1.1%
Minor Repair, Acoustic Tile Ceiling	1.60	1.0%
Replace Ballast & Lamps, Fluorescent Lighting Fixture, 160w	1.45	0.9%
Refinish Steel, Painted, Interior Door	1.42	0.9%
Replace Fluorescent Lighting Fixture, 160w	1.27	0.8%
Minor Repair, Sheetrock, Stippled, Interior Wall Finish	.95	0.6%
Replace Incandescent Lighting Fixture, Basic, 100w	.86	0.5%
Annual PM, Distribution Panel Board	.85	0.5%
Non-Destructive Moisture Inspection	.84	0.5%
Replace Pipe Insulation, Cold Water	.77	0.5%
Repair Clay Brick, Exterior, 1st Floor	.77	0.5%

**Task cost ($2002) per gross square foot over 50 years.*
***Percent of total M&R costs.*

Cost per Sqft. by System

Building Age	Exterior Closure	Roofing	Interior Construction	Stairways	Interior Finish	Conveying Systems	Plumbing Systems	HVAC Systems	Fire Protection	Electrical Systems	Equipment	Total per Sqft.
1	.02	.53	.30				.19	.16	.16	.10		**1.45**
2	.02	.53	.30		.01		.39	.16	.16	.10		**1.66**
3	.02	.58	.30				.19	.16	.16	.10		**1.50**
4	.02	.53	.41		1.16		.39	.16	.16	.10		**2.93**
5	.02	.53	.30				.30	.16	.22	.32		**1.84**
6	.02	.58	.30		.01		.39	.16	.16	.10		**1.71**
7	.02	.61	.30				.20	.16	.16	.10		**1.54**
8	.02	.53	.41		3.39		1.08	.16	.16	.11		**5.86**
9	.02	.58	.30		.34		.19	.16	.16	.10		**1.84**
10	2.79	.53	2.06		.01		.89	3.27	.42	.91		**10.89**
11	.02	.53	.30				.19	.16	.16	.10		**1.45**
12	.09	.58	.41		1.16		.39	.16	.16	.10		**3.06**
13	.02	.53	.30				.38	.16	.16	.10		**1.64**
14	.02	2.26	.30		.01		.40	.16	.16	.10		**3.41**
15	.02	.58	.30				.21	5.09	.22	.69		**7.11**
16	.02	.53	.41		3.39		1.08	.16	.16	.11		**5.86**
17	.02	.53	.30				.19	.16	.16	.10		**1.45**
18	.02	.58	.30		1.32		.39	.16	.16	.10		**3.02**
19	.02	.53	.30				.19	.16	.16	.10		**1.45**
20	2.79	.78	2.18		1.90		1.28	.31	.39	1.73		**11.37**
21	.02	.66	.30				.29	.16	.16	.10		**1.68**
22	.02	.53	.30		.01		.39	.16	.16	.10		**1.66**
23	.02	.53	.30				.19	.16	.16	.10		**1.45**
24	.09	.58	.41		3.39		1.08	.16	.16	.11		**5.99**
25	2.15	.53	.30				7.28	3.27	.22	.62		**14.36**
26	.02	.53	.30		.01		.47	.16	.16	.10		**1.75**
27	.02	.58	.30		.34		.20	.16	.16	.10		**1.85**
28	.02	3.41	.41		1.16		.39	.16	.16	.10		**5.82**
29	.02	.53	.30				.28	.16	.16	.10		**1.55**
30	2.79	.53	2.06		.01		.88	5.09	.42	1.18		**12.96**
31	.02	.58	.30				.20	.16	.16	.10		**1.51**
32	.02	.53	.41		3.39		1.07	.16	.16	.10		**5.84**
33	.02	.53	.30				.20	.16	.16	.11		**1.46**
34	.02	.58	.30		.01		.37	.16	.16	.10		**1.70**
35	.02	.61	.30				.84	.16	.22	.32		**2.47**
36	.09	.53	.41		2.47		.30	.16	.16	.10		**4.22**
37	.02	.58	.30				.36	.16	.16	.10		**1.67**
38	.02	.53	.30		.01		.31	.16	.16	.10		**1.58**
39	.02	.53	.30				.38	.16	.16	.10		**1.64**
40	2.79	.83	2.18		4.13		1.94	3.42	.39	1.83		**17.53**
41	.02	.53	.30				.28	.16	.16	.11		**1.54**
42	.02	2.26	.30		.01		.31	.16	.16	.10		**3.32**
43	.02	.58	.30				.28	.16	.16	.10		**1.59**
44	.02	.53	.41		1.16		.30	.16	.16	.10		**2.84**
45	.02	.53	.30		.34		.51	5.09	.22	.69		**7.70**
46	.02	.58	.30		.01		.30	.16	.16	.10		**1.63**
47	.02	.53	.30				.28	.16	.16	.10		**1.54**
48	.09	.53	.41		3.39		.99	.16	.16	.10		**5.84**
49	.02	.66	.30				.29	.16	.16	.11		**1.68**
50	4.92	.53	2.06		.01		7.80	.16	.42	1.00		**16.90**
Total	19.24	34.33	25.05		32.60		37.63	32.39	9.61	13.45		204.31

50 Year Profile, Total Cost per Sqft.



A value of "0.00" means a cost of more than $.000 but less than $.005 per gross square foot.

3. Local M&R Costs

The statistics in this chapter focus on local maintenance costs for 210 major U.S. and Canadian metropolitan areas. Three types of measures are presented:

- **Local maintenance cost indexes** measure relative maintenance and repair (M&R) costs across metro areas
- **In-house shop rates** for trades and supervisory positions common to the in-house M&R staff
- **Contract labor rates** for trades common in M&R construction

The local maintenance cost index is based on the M&R costs of a two-story office building (shown in Chapter 2) standardized to the Washington DC area. The range of the index is considerable, as indicated in Table 3.1. Costs in New York, NY are an estimated 54% higher than those in Washington DC for the same building. In the other direction, M&R costs in Columbus, GA are an estimated 35% lower than the Washington DC value. This index can be used for simple comparisons among metro areas, and also used to adjust the cost profiles in Chapter 2 for metro areas other than Washington DC (the original area for which the profiles were estimated).

Table 3-1.
Comparison of M&R Costs by Metro Area

Metro Area	Local Maintenance Cost Index*	Metro Area	Local Maintenance Cost Index*	Metro Area	Local Maintenance Cost Index*	Metro Area	Local Maintenance Cost Index*
New York, NY	153.9	Olympia, WA	101.7	Kalamazoo, MI	88.4	Burlington, VT	76.3
Yonkers, NY	139.5	Tacoma, WA	101.7	Bowling Green, KY	88.3	Fargo, ND	76.3
San Francisco, CA	136.6	Buffalo, NY	101.5	Green Bay, WI	88.3	Rutland, VT	76.1
San Jose, CA	130.2	San Diego, CA	101.5	Springfield, MO	87.9	Waco, TX	75.9
Honolulu, HI	126.5	Milwaukee, WI	101.4	Owensboro, KY	87.5	Norfolk, VA	75.6
Oakland, CA	124.9	Akron, OH	101.3	Concord, NH	87.4	Macon, GA	75.4
Newark, NJ	124.4	Charleston, WV	101.2	Manchester, NH	87.4	Wichita Falls, TX	75.2
Jersey City, NJ	124.4	Worcester, MA	100.8	Cedar Rapids, IA	87.3	Bismarck, ND	75.1
Philadelphia, PA	124.2	Medford, OR	100.7	Pueblo, CO	87.3	Tuscaloosa, AL	74.7
Trenton, NJ	123.9	Indianapolis, IN	100.4	Watertown, NY	87.2	Virginia Beach, VA	73.4
Hilo, HI	123.4	Duluth, MN	100.3	Cleveland, OH	86.2	Newport News, VA	73.2
New Brunswick, NJ	122.5	Washington DC	100.0	Omaha, NE	86.1	Orlando, FL	72.8
Camden, NJ	121.6	Ann Arbor, MI	100.0	Houston, TX	85.7	Grand Rapids, MI	72.8
Atlantic City, NJ	121.6	Fall River, MA	99.9	Memphis, TN	85.3	Amarillo, TX	72.7
Boston, MA	119.8	Scranton, PA	99.7	Portland, ME	85.3	Tampa, FL	72.5
Chicago, IL	117.8	Peoria, IL	99.5	Colorado Springs, CO	85.1	Chattanooga, TN	72.3
Stamford, CT	117.4	Columbus, OH	99.0	Phoenix, AZ	85.0	Tulsa, OK	72.2
Wilmington, DE	111.0	Springfield, MA	99.0	Miami, FL	84.4	Hampton, VA	71.9
Kansas City, MO	110.2	Moline, IL	98.4	Boise, ID	83.8	El Paso, TX	71.6
Los Angeles, CA	109.7	Flint, MI	98.1	Salt Lake City, UT	83.6	Savannah, GA	71.5
Minneapolis, MN	108.8	Dayton, OH	97.7	New Orleans, LA	83.5	Corpus Christi, TX	71.5
Lowell, MA	108.1	Terre Haute, IN	97.7	Marquette, MI	83.1	Boulder, CO	71.5
Norwalk, CT	108.1	Springfield, OH	97.4	Wichita, KS	83.0	Biloxi, MS	71.0
Anaheim, CA	108.1	Cincinnati, OH	97.4	Billings, MT	82.6	Sioux Falls, SD	69.8
Danbury, CT	108.0	Youngstown, OH	97.2	Beaumont, TX	82.6	Cheyenne, WY	69.1
Santa Barbara, CA	108.0	Richland, WA	96.9	Pocatello, ID	82.5	Lubbock, TX	67.3
St. Louis, MO	107.3	Baltimore, MD	96.8	Lewiston, ME	82.3	Columbus, GA	65.4
Fairbanks, AK	106.9	Reading, PA	96.7	Albuquerque, NM	82.1	Rapid City, SD	65.1
Detroit, MI	106.9	Rochester, MN	96.2	Sioux City, IA	82.0	Roanoke, VA	64.5
Oxnard, CA	106.7	Harrisburg, PA	96.1	Austin, TX	82.0	Tallahassee, FL	64.1
Pittsburgh, PA	106.5	Madison, WI	96.1	Altus, OK	81.3	Raleigh-Durham, NC	64.0
Stockton, CA	106.3	Kokomo, IN	96.0	Lawton, OK	81.3	Winston-Salem, NC	63.9
Juneau, AK	106.2	Carson City, NV	95.5	Daytona Beach, FL	81.3	Greensboro, NC	62.9
Sacramento, CA	106.0	Reno, NV	95.5	San Antonio, TX	81.1	Charlotte, NC	62.9
Las Vegas, NV	105.8	Rochester, NY	95.4	Tucson, AZ	81.0	Jackson, MS	62.8
Salem, OR	105.1	Lansing, MI	94.7	Oklahoma City, OK	80.5	Columbia, SC	61.8
Anchorage, AK	105.0	Louisville, KY	94.2	Great Falls, MT	80.2	Charleston, SC	61.7
Rockford, IL	104.9	Muncie, IN	94.1	Nashville, TN	80.0	Beaufort, SC	56.2
Toledo, OH	104.8	Saginaw, MI	94.0	Richmond, VA	79.8		
Portland, OR	104.7	Davenport, IA	93.4	Ogden, UT	79.6	**Canadian Cities**	
Riverside, CA	104.7	Erie, PA	93.2	Dallas, TX	79.5		
Eugene, OR	104.6	South Bend, IN	92.9	Birmingham, AL	79.5	Toronto, Ontario	103.4
Gary, IN	104.5	Evansville, IN	92.5	Fort Smith, TX	79.1	Hamilton, Ontario	99.1
Seattle, WA	103.9	Battle Creek, MI	92.3	Fort Worth, TX	78.7	London, Ontario	97.0
New Haven, CT	103.3	Albany, NY	92.3	Alamogordo, NM	78.7	Ottawa, Ontario	95.3
Waterbury, CT	103.2	Denver, CO	91.3	Jacksonville, FL	78.6	Vancouver, B.C.	95.0
Springfield, IL	103.0	Spokane, WA	90.8	Las Cruces, NM	78.4	Quebec, Quebec	86.3
Parkersburg, WV	102.9	Syracuse, NY	90.7	Fort Lauderdale, FL	78.3	Montreal, Quebec	85.2
Fresno, CA	102.9	Cumberland, MD	90.1	Shreveport, LA	78.1	Calgary, Alberta	79.2
Bakersfield, CA	102.7	Topeka, KS	89.9	Mobile, AL	77.5	Edmonton, Alberta	79.1
Brockton, MA	102.1	Atlanta, GA	89.8	Lexington, KY	77.3	Winnipeg, Manitoba	78.9
Providence, RI	102.1	Des Moines, IA	89.8	Huntsville, AL	77.1		
Hartford, CT	102.0	Utica, NY	89.8	Little Rock, AR	77.1		
Norwich, CT	102.0	Eau Claire, WI	89.3	Knoxville, TN	76.3		

*Total average cost, Washington DC=100; Canadian cities are in Canadian dollars.

3.1 Local Maintenance Cost Indexes, Selected Metro Areas

Area	Cost per Sqft.	Local Index	200 Area Ranking
Chicago, IL			
PM & Minor Repair	$ .46	129.7	15
Unscheduled Maintenance	.47	133.9	15
Renewal & Replacement	1.48	110.4	16
Total Average Cost	2.41	117.8	16
Cincinnati, OH			
PM & Minor Repair	.32	90.5	113
Unscheduled Maintenance	.31	89.1	112
Renewal & Replacement	1.36	101.3	48
Total Average Cost	1.99	97.4	78
Cleveland, OH			
PM & Minor Repair	.33	94.4	98
Unscheduled Maintenance	.33	93.4	97
Renewal & Replacement	1.10	82.1	141
Total Average Cost	1.76	86.2	119
Colorado Springs, CO			
PM & Minor Repair	.32	91.5	110
Unscheduled Maintenance	.31	90.1	110
Renewal & Replacement	1.10	82.1	142
Total Average Cost	1.74	85.1	124
Columbia, SC			
PM & Minor Repair	.17	49.2	198
Unscheduled Maintenance	.14	41.5	198
Renewal & Replacement	.94	70.4	195
Total Average Cost	1.26	61.8	198
Columbus, GA			
PM & Minor Repair	.19	52.6	191
Unscheduled Maintenance	.16	45.3	191
Renewal & Replacement	.99	74.1	182
Total Average Cost	1.34	65.4	189
Columbus, OH			
PM & Minor Repair	.32	91.6	108
Unscheduled Maintenance	.32	90.3	108
Renewal & Replacement	1.38	103.2	34
Total Average Cost	2.02	99.0	71
Concord, NH			
PM & Minor Repair	.30	86.0	126
Unscheduled Maintenance	.29	83.6	127
Renewal & Replacement	1.19	88.8	107
Total Average Cost	1.79	87.4	114
Corpus Christi, TX			
PM & Minor Repair	.22	63.1	184
Unscheduled Maintenance	.20	57.6	184
Renewal & Replacement	1.04	77.4	169
Total Average Cost	1.46	71.5	183
Cumberland, MD			
PM & Minor Repair	$ .32	90.5	112
Unscheduled Maintenance	.31	89.1	111
Renewal & Replacement	1.21	90.3	100
Total Average Cost	1.84	90.1	103
Dallas, TX			
PM & Minor Repair	.28	77.9	148
Unscheduled Maintenance	.26	74.5	148
Renewal & Replacement	1.09	81.3	147
Total Average Cost	1.63	79.5	149
Danbury, CT			
PM & Minor Repair	.38	107.9	45
Unscheduled Maintenance	.38	109.1	45
Renewal & Replacement	1.45	107.8	21
Total Average Cost	2.21	108.0	25
Davenport, IA			
PM & Minor Repair	.34	97.3	89
Unscheduled Maintenance	.34	96.7	89
Renewal & Replacement	1.23	91.5	95
Total Average Cost	1.91	93.4	94
Dayton, OH			
PM & Minor Repair	.33	93.5	103
Unscheduled Maintenance	.32	92.4	103
Renewal & Replacement	1.34	100.1	55
Total Average Cost	2.00	97.7	75
Daytona Beach, FL			
PM & Minor Repair	.24	68.9	177
Unscheduled Maintenance	.22	64.2	177
Renewal & Replacement	1.19	89.1	105
Total Average Cost	1.66	81.3	141
Denver, CO			
PM & Minor Repair	.35	98.3	85
Unscheduled Maintenance	.34	97.8	85
Renewal & Replacement	1.18	87.8	114
Total Average Cost	1.87	91.3	100
Des Moines, IA			
PM & Minor Repair	.33	93.7	102
Unscheduled Maintenance	.32	92.6	102
Renewal & Replacement	1.18	88.0	113
Total Average Cost	1.83	89.8	106
Detroit, MI			
PM & Minor Repair	.41	116.2	26
Unscheduled Maintenance	.41	118.1	26
Renewal & Replacement	1.36	101.5	46
Total Average Cost	2.18	106.9	29

Note: Costs per Sqft. are the annual average costs, over a 50 year service life, of maintaining the two-story office building shown in Chapter 2. Local Indexes are standardized (equal 100) for the Washington DC area.

Fermilab

FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:

Bill Shull

Project Number

6-8-3

UIP ECP (If applicable)

Project Phase:

Comment and Compliance

Comment Date:

February 12, 2004

Print

Duplicate

Main Menu

COMMENT

Drawing Reference:

START WITH PAGE NUMBER FIRST FOLLOWED BY SECTION OR DETAIL REFERENCE. Example: A-1, Detail 4

Specification Reference:

PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

No comments

RESPONSE

Project Contact Response:

Thank You for Reviewing this Project

Comment:

Fermilab
FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:
Bob Mau

Project Number
6-8-3

UIP ECP (If applicable)

Project Phase:
Comment and Compliance

Comment Date:
February 16, 2004

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COMMENT

Drawing Reference:

START WITH PAGE NUMBER FIRST FOLLOWED BY SECTION OR DETAIL REFERENCE. Example: A-1, Detail 4

Specification Reference:

PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

There is a new 13.8 cable to be installed that looks like it will cut through the Berm(impacts radiation shielding). This must clearly be carefully coordinated.

where is the dividing line between PPD and AD at this building

RESPONSE

Project Contact Response:

Agree and will incorporate comments

Comment:

These discussions are on-going.

Fermilab
FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:
C. Worby

Project Number
6-8-3

UIP ECP (If applicable)

Project Phase:
Comment and Compliance

Comment Date:
February 10, 2004

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COMMENT

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Specification Reference:

PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

No comments

RESPONSE

Project Contact Response:

Thank You for Reviewing this Project

Comment:

Fermilab
FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:
David Baird

Project Number
6-8-3

UIP ECP (If applicable)

Project Phase:
Comment and Compliance

Comment Date:
February 6, 2004

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COMMENT

Drawing Reference:

START WITH PAGE NUMBER FIRST FOLLOWED BY SECTION OR DETAIL REFERENCE. Example: A-1, Detail 4

Specification Reference:

PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

I have no comments regarding this review at this time. - Dave.

RESPONSE

Project Contact Response:

Thank You for Reviewing this Project

Comment:

Fermilab
FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:
Ed Temple

Project Number
6-8-3

UIP ECP (If applicable)

Project Phase:
Comment and Compliance

Comment Date:
February 16, 2004

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COMMENT

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PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

I have only three comments both of an editorial nature:
1) On page 8 under Electrical I believe "quite power" should be "quiet power."
2) about 10 drawings are in the document twice.
3) other typographical and grammatical errors might be reduced by an editor.

RESPONSE

Project Contact Response:

Agree and will incorporate comments

Comment:

Fermilab
FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:
Jim Elliott

Project Number
6-8-3

UIP ECP (If applicable)

Project Phase:
Comment and Compliance

Comment Date:
February 6, 2004

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COMMENT

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START WITH PAGE NUMBER FIRST FOLLOWED BY SECTION OR DETAIL REFERENCE. Example: A-1, Detail 4

Specification Reference:

PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

No comments

RESPONSE

Project Contact Response:

Thank You for Reviewing this Project

Comment:

Fermilab
FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:

Joe Howell

Project Number

6-8-3

UIP ECP (If applicable)

Project Phase:

Comment Date:

February 19, 2004

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COMMENT

Drawing Reference:

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Specification Reference:

PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

Need to add user cable penetrations between computer floor.

RESPONSE

Project Contact Response:

Agree and will incorporate comments

Comment:

Fermilab
FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:

John Anderson John Foglesong

Project Number

6-8-3

UIP ECP (If applicable)

Project Phase:

Comment and Compliance

Comment Date:

February 16, 2004

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COMMENT

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Specification Reference:

PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

The 150KVA transformer for the collision hall experiment electronics from SWBD-C0-1 is not listed as a type K-4 as are all the other transformers. Shouldn't it be the same type?

RESPONSE

Project Contact Response:

Agree and will incorporate comments

Comment:

The 1500kva transformer that will be specified is the Fermilab standard pulse power pad mounted transformers. All 1500 KVA transformers will use the same specifications.

Fermilab
FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:
John Anderson John Foglesong

Project Number
6-8-3

UIP ECP (If applicable)

Project Phase:
Comment and Compliance

Comment Date:
February 16, 2004

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COMMENT

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PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

The one-line drawing shows two 75 KVA transformers that service the 1st floor counting room. If we look at page M-2 of drawing 6-8-3, we find 58 relay rack positions and a total power draw estimate of 132 kW. Division gives about 2kW per rack position; many relay racks already determined in the experiment have power draws in excess of this number. Further, the 132kW expected load is dangerously close to the 150kW of total AC available from the two transformers. We should probably allow for larger transformers - or a third 75KVA unit.

RESPONSE

Project Contact Response:

Disagree for Reasons Noted Below

Comment:

The space avalliable as the drawing shows only allow for roughly 45 racks. We will verify that the supplied power is aduquate for the rack electrical loads.

Fermilab
FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:
John Anderson John Foglesong

Project Number
6-8-3

UIP ECP (If applicable)

Project Phase:
Comment and Compliance

Comment Date:
February 16, 2004

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COMMENT

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Specification Reference:

PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

We also want to clarify the intended usage of PP-C0-1-11, -12, -13 and -14. These are intended to be simple panels with a minimum number of breakers mounted to the wall in the collision hall area and are not the final panelboards to distribute power to each relay rack. The panelboards with individual breakers for each circuit will have to be mounted to the relay racks at a later time when the equipment is actually installed. The feed from, for example, PP-C0-1-11 to the associated panelboard on the racks will be a conduit of one large circuit with broken ground. The ground is broken because PP-C0-1-11 will obviously be tied directly to the building but the panelboard on the relay racks will be inductively isolated from the building ground. We foresee the panelboards on the rack groups to be installed much later using T&M contracts

RESPONSE

Project Contact Response:

Agree and will incorporate comments

Comment:

Fermilab

FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:

John Anderson John Foglesong

Project Number: **6-8-3**

UIP ECP (If applicable):

Project Phase:

Comment and Compliance

Comment Date:

February 16, 2004

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COMMENT

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Specification Reference:

PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

With regard to section 2.1.3.2, the four panels PP-C0-1-11 thru PP-C0-1-14 are the four referenced in this section and the section is being updated to match. We picture the panel in the collision hall for 'non detector electronics' to be PHP-C0-3-6-1, and that this panel controls lights but has only the minimum number of convenience outlets necessary for powering tools during the installation of lights and the relay racks. Our concern is outlets that might be used by experimenters after installation is complete that would violate the detector grounding scheme. We plan on providing convenience outlets throughout the rack areas so only the minimal number of outlets from PHP-C0-3-6-1 should be installed. Panel PHP-C0-3-5 in the assembly hall should have a few 208VAC 3-phase circuits relegated to use by electronics commissioning, but again, this is seen as a relatively small load

RESPONSE

Project Contact Response:

Agree and will incorporate comments

Comment:

Fermilab
FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:
Michael Gerardi

Project Number
6-8-3

UIP ECP (If applicable)

Project Phase:
Comment and Compliance

Comment Date:
February 16, 2004

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COMMENT

Drawing Reference:

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Specification Reference:

PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

During operational periods excavation that has the potential of compromising the Tevatron shielding cannot be allowed without further discussion and approval. As you might expect it has far reaching implications. This includes the feeders, concrete encased duct bank, transformer pads, heating and air conditioning ducts, and the new southeast stairwell.

RESPONSE

Project Contact Response:

Agree and will incorporate comments

Comment:

Fermilab

FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:

Michael Gerardi

Project Number

6-8-3

UIP ECP (If applicable)

Project Phase:

Comment and Compliance

Comment Date:

February 16, 2004

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COMMENT

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PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

Have the design modifications been reviewed in general wrt rad safety and prompt radiation ?

Have the design modifications been reviewed wrt operational impact to the Tev ?

RESPONSE

Project Contact Response:

Thank You for Reviewing this Project

Comment:

The "C-0 Test Area" project was reviewed in 1998. During Title 2 any modifications will need further review.

Fermilab
FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:
Michael Gerardi

Project Number: **6-8-3**

UIP ECP (If applicable):

Project Phase:
Comment and Compliance

Comment Date:
February 16, 2004

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COMMENT

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Specification Reference:

PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

Rad Training requirements should be defined and explicit in the text.

RESPONSE

Project Contact Response:

Disagree for Reasons Noted Below

Comment:

The Rad training requirements are important and needs consideration but are better addressed in Title 2. Current understanding of what will be required should not affect cost or schedule if considered during Title 2.

Fermilab
FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:
Michael Gerardi

Project Number
6-8-3

UIP ECP (If applicable)

Project Phase:
Comment and Compliance

Comment Date:
February 16, 2004

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COMMENT

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Specification Reference:

PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

The duct connection to the collision hall should be reviewed for design adequacy to insure compliance with FRCM guidance.

RESPONSE

Project Contact Response:

Agree and will incorporate comments

Comment:

Fermilab

FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:

Michael Gerardi

Project Number

6-8-3

UIP ECP (If applicable)

Project Phase:

Comment and Compliance

Comment Date:

February 16, 2004

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COMMENT

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Specification Reference:

PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

The [northwest] stairwell should be reviewed for design adequacy to insure compliance with FRCM guidance.

RESPONSE

Project Contact Response:

Agree and will incorporate comments

Comment:

The stair is within 50' of the berm and therefore will require a shielding assessment drawing prior to construction. A mention that this work is required will be incorporated.

Fermilab
FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:
Michael Gerardi

Project Number
6-8-3

UIP ECP (If applicable)

Project Phase:
Comment and Compliance

Comment Date:
February 16, 2004

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COMMENT

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PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

The TeV berm is assessed as a minimally occupied area during operation and a section of that berm is actually posted. The possibility of any extended occupancy will need to be re-evaluated and approved prior to any activity.

RESPONSE

Project Contact Response:

Disagree for Reasons Noted Below

Comment:

A shielding analysis was accomplished during the 1998 design phase. No change in occupancy is anticipated.

Fermilab
FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:
Mike Church

Project Number
6-8-3

UIP ECP (If applicable)

Project Phase:
Comment and Compliance

Comment Date:
March 9, 2004

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COMMENT

Drawing Reference:

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Specification Reference:

PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

Gantt chart: has wrong dates for '05 and '06 shutdowns. Official dates in BTeV milestones are 8/8/05 - 9/30/05, 8/7/06 - 9/29/06. But will probably change anyway.

RESPONSE

Project Contact Response:

Agree and will incorporate comments

Comment:

Fermilab

FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:

Mike Church

Project Number

6-8-3

UIP ECP (If applicable)

Project Phase:

Comment and Compliance

Comment Date:

March 9, 2004

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COMMENT

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PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

In several places you refer to "Test Hall". Do you mean "Collision Hall"? If so, it might be a good idea to change it for uniformity. (The C0 IR Design Report uses "Collision Hall".)

RESPONSE

Project Contact Response:

Agree and will incorporate comments

Comment:

"Collision Hall" will be used.

Fermilab

FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:

Mike Church

Project Number

6-8-3

UIP ECP (If applicable)

Project Phase:

Comment and Compliance

Comment Date:

March 9, 2004

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COMMENT

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PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

pg 6: You say "all" LCW piping will be under the C0 IR project. Not quite. We take the headers into the Collision Hall and Assembly Hall, but manifolding and distribution will be taken care of by some other part of the BTeV project.

RESPONSE

Project Contact Response:

Agree and will incorporate comments

Comment:

It is my current understanding that all LCW will either be installed under the IR or under 1.10. I will correct my document in a way not to interject an agreement or boundaries between WBS 2.0 and 1.10.

Fermilab
FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:

Mike Church

Project Number

6-8-3

UIP ECP (If applicable)

Project Phase:

Comment and Compliance

Comment Date:

March 9, 2004

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COMMENT

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PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

pg. 6: You say that 97% of the magnet loads is 647KW. John Riordan's latest number is 599KW = 100%. I suggest you discuss with him and come to an agreement.

RESPONSE

Project Contact Response:

Response Incomplete, Additional Information to Follow

Comment:

We are removing mention of this load from the WBS 3.0 documents and should be coordinated between WBS 1.10 and WBS 2.0.

Fermilab

FESS/Engineering

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Reviewer:

Mike Church

Project Number

6-8-3

UIP ECP (If applicable)

Project Phase:

Comment and Compliance

Comment Date:

March 9, 2004

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COMMENT

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PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

pg 8: Our power requirements at B4 and C1 have changed. I will set up a meeting next week with you George and others to discuss this issue and some other issues.

RESPONSE

Project Contact Response:

Agree and will incorporate comments

Comment:

Weekly meeting have staRTED AND THIS CHANGE HAS BEEN DISCUSSED AND OUR DOCUMENTS REVISED.

Fermilab
FESS/Engineering

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PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:

Mike Church

Project Number

6-8-3

UIP ECP (If applicable)

Project Phase:

Comment and Compliance

Comment Date:

March 9, 2004

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COMMENT

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PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

pg 8: You say that feeder 45 will be routed from C4. Do you really mean B4? I assume that this feeder will be routed through the berm via the same carrier pipe that will eventually contain the new feeder 59?

RESPONSE

Project Contact Response:

Agree and will incorporate comments

Comment:

Fermilab
FESS/Engineering

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Reviewer:
Mike Church

Project Number
6-8-3

UIP ECP (If applicable)

Project Phase:
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Comment Date:
March 9, 2004

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Comment:

The 2 items that will require review/inspection by the Tevatron group for compliance with radiaton shielding are 1) carrier pipe carrying the feeders across the berm, and 2) concrete piers in the berm supporting the housing for the new buswork. Both very minor issues.

RESPONSE

Project Contact Response:

Agree and will incorporate comments

Comment:

Comments will be incorporated during final design.

Fermilab
FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:
Mike Church

Project Number
6-8-3

UIP ECP (If applicable)

Project Phase:
Comment and Compliance

Comment Date:
March 9, 2004

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PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

Your C0 service building layout needs to be changed. Again, I will arrange a meeting with relevant parties next week to discuss the issues.

RESPONSE

Project Contact Response:

Agree and will incorporate comments

Comment:

The updated design is included in this review.

Fermilab

FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:

Peter Garbincius

Project Number

6-8-3

UIP ECP (If applicable)

Project Phase:

Comment and Compliance

Comment Date:

February 16, 2004

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COMMENT

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PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

Also John Riordan has to understand how to install, maintain, service, remove above ground water cooled bus in the 3'x3' duct. There should be discussion on ODH and Radiation safety for contractors, specifically when entering C0 Experimental Hall without isolation from Tevatron tunnel, for work shown on drawings M-6 and E-6.

RESPONSE

Project Contact Response:

Agree and will incorporate comments

Comment:

Fermilab

FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:

Peter Garbincius

Project Number

6-8-3

UIP ECP (If applicable)

Project Phase:

Comment and Compliance

Comment Date:

February 16, 2004

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COMMENT

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PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

p6 - where is the hand-off of MR LCW from AD to PPD/BTeV?

RESPONSE

Project Contact Response:

Agree and will incorporate comments

Comment:

This issue will need to be addressed by the project , PPD and Accellerator division management for both during construction and operations.

Fermilab

FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:

Peter Garbincius

Project Number

6-8-3

UIP ECP (If applicable)

Project Phase:

Comment and Compliance

Comment Date:

February 16, 2004

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PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

There has to be some discussion of interfacing the M-6 - E-6 work with the other shutdown work in the C0 Experimental Hall, specifically when, how long, and limitations on access.

Need to determine when is the C0 Experimental Hall turned over from AD to PPD/BTeV.

RESPONSE

Project Contact Response:

Agree and will incorporate comments

Comment:

These discussions are on-going.

Fermilab
FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:
Peter Garbincius

Project Number
6-8-3

UIP ECP (If applicable)

Project Phase:
Comment and Compliance

Comment Date:
February 16, 2004

Print | Duplicate | Main Menu

COMMENT

Drawing Reference:
A-12

START WITH PAGE NUMBER FIRST FOLLOWED BY SECTION OR DETAIL REFERENCE. Example: A-1, Detail 4

Specification Reference:

PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

drawing A-12 - Need to show power supplies, reversing switches, and accessories for electrostatic separators in C0 Service Building.
I asked George Krafczyk to provide this information.

RESPONSE

Project Contact Response:

Agree and will incorporate comments

Comment:

This information has been provided and is represented on the current drawings.

Fermilab
FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:
Steve Krstulovich

Project Number: **6-8-3**

UIP ECP (If applicable):

Project Phase:
Comment and Compliance

Comment Date:
February 12, 2004

Print | Duplicate | Main Menu

COMMENT

Drawing Reference:

START WITH PAGE NUMBER FIRST FOLLOWED BY SECTION OR DETAIL REFERENCE. Example: A-1, Detail 4

Specification Reference:

PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

The Comment and Compliance Review package for the C-0 Occupancy looks good. One point you might want to make in the mechanical description of the 55F ECW system is that CHW temperature will be controlled through the HX to keep above the room dewpoint (by 3F-5F?) to preclude condensation in the electronics racks.

RESPONSE

Project Contact Response:

Agree and will incorporate comments

Comment:

Fermilab
FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:
Teri Dykhuis

Project Number
6-8-3

UIP ECP (If applicable)

Project Phase:
Comment and Compliance

Comment Date:
February 13, 2004

Print

Duplicate

Main Menu

COMMENT

Drawing Reference:

START WITH PAGE NUMBER FIRST FOLLOWED BY SECTION OR DETAIL REFERENCE. Example: A-1, Detail 4

Specification Reference:

PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:

I don't have any comments on this project.
Teri

RESPONSE

Project Contact Response:

Thank You for Reviewing this Project

Comment:

Fermilab
FESS/Engineering

Please ensure that your review included a review of the project for appropriateness of the proposed systems, impacts on existing systems and operations and specific technical requirements to be incorporated into the design

PLEASE ENTER THE FOLLOWING INFORMATION

Reviewer:
Tony Kanyok

Project Number
6-8-3

UIP ECP (If applicable)

Project Phase:
Comment and Compliance

Comment Date:
February 6, 2004

Print | Duplicate | Main Menu

COMMENT

Drawing Reference:

START WITH PAGE NUMBER FIRST FOLLOWED BY SECTION OR DETAIL REFERENCE. Example: A-1, Detail 4

Specification Reference:

PROVIDE SPECIFICATION SECTION AND PARAGRAPH IF APPLICABLE. Example: 02070 1.5.D.2 (Page 02070-2)

Comment:
No comments

RESPONSE

Project Contact Response:
Thank You for Reviewing this Project

Comment:

WBS 3.0, C-0 Outfitting
of the
BTeV Project
Sub-Project Execution Plan

April 2004

Fermilab

Fermi National Accelerator Laboratory

A Department of Energy National Laboratory

Managed by Universities Research Association

FESS/Engineering Project No. 6-8-3

Rev. 0

The objective of the reporting and review activity is to provide the assemblage and integration of project related cost data, schedule status and performance progress into reports for the monitoring and management of the project.

Reporting

Daily – If appropriate, construction logs may be prepared by the Construction Coordinator that document the ongoing progress, quality assurance, safety and change issues. When required, the Subcontractor prepares daily quality control reports documenting their efforts on field activities. The Project Manager and Construction Manager are provided these reports on the following workday.

Weekly – The Subcontractor submits a summary report of quality control activities for the previous week at the weekly construction meeting. These reports will include a “look ahead” schedule that details the expected progress in the coming weeks.

Quarterly - The Project Manager will review construction progress, changes, Subcontractor payouts and general project progress in order to prepare a Quarterly GPP report.

Reviews

Directorate Level Review – If appropriate and requested, the project team will meet with the Directorate to review the project related cost data, schedule status and performance progress.

Multi-Organization Construction Site Safety Walkthrough – These walkthroughs will occur on a bi-weekly basis or as requested by the participants. The walkthroughs will be completed in accordance with the ES&H section procedure. A copy of the procedure is included in the Appendix of this document.

The Project Execution Plan (PEP) describes the management, control systems and procedures used by Fermi National Accelerator Laboratory (Fermilab) to meet the technical, cost, and schedule objectives of the conventional construction for this project. This controlling document establishes the basis against which progress will be measured.

This project will be managed based on the guidance provided in DOE Manual 413.3-1. This manual is not the sole source for all requirements and guidance that apply to the acquisition of capital assets. Other DOE Order and Manuals, especially regarding design, engineering, management reserve and indirect costs have been used to determine the basis for estimating costs and establishing baselines. This identification, implementation and compliance with other relevant Orders, Manuals and requirements is the responsibility of the Integrated Project Team.

The PEP is to be viewed as a “living document,” and as such, will be revised when necessary. The Project Manager is authorized to approve non-substantive changes to the PEP (e.g. name changes to the positions sited in the PEP), but will inform the DOE Project Manager via e-mail of such changes. Baseline changes will require approval by the Department of Energy’s (DOE) Fermi Area Office.

SUBMITTAL PAGE

C-0 Outfitting

Submitted, Accepted, and Approved By:

Jane Monhart Date
DOE Area Office Manager
Fermi Area Office

Paul Philp Date
DOE Project Director
Fermi Area Office

Kenneth Stanfield Date
Deputy Director
Fermilab Directorate

John Cooper Date
Particle Physics Division Head

Joel Butler Date Sheldon Stone Date
Project Directors

David Nevin Date
Facilities Engineering Services Section Head

Thomas Lackowski Date
Construction Manager
Facilities Engineering Services Section

PROJECT OBJECTIVES **C-0 Outfitting**

The physics and technical objectives for the BTeV project are described in the overall BTeV Project Execution Plan (PEP). This document is meant to augment the project's PEP with the applicable DOE and Fermilab requirements for WBS 3.0 C-0 Outfitting. General requirements such as progress reporting and change control between level two sub-projects will conform to the BTeV project's PEP in addition to applicable portions of this document.

The objective of the C-0 Outfitting is to construct the scope to support the BTeV project, for the cost presented within this document, meeting the schedule milestones agreed to for the overall project. As with all projects, accomplishing these tasks in a safe manner to the environment, to all workers and the end users is a priority.

The C-0 Outfitting site work involves upgrades of the existing C-0 Test Area Building constructed in 1998 to install the power and mechanical services required to support the BTeV project. Upgrades to the site area includes the construction of mechanical equipment and Dewar support pads, a shed type building for gas bottles, underground utility work for and a new 13.8 KV feeder duct bank from the existing manhole at the B-4 Service Building to a new transformer pad at the C-0 Building. The transformer pad will contain three new 1500 KVA transformers, 13.8 kv switchgear and a 250 KVA Diesel Generator. Included in the site electrical work will be the construction of a new bus duct enclosure from the C-0 Service Building to the Collision Hall. Also included is the installation of a new 1500 KVA transformer at the C-0 Service building and new 500 KVA transformers at service buildings B-4 and C-1.

The architectural build out portion of this project consists primarily of the installation of walls, doors, finishes, stairs, elevator, and raised computer flooring. Once the concrete floors have been installed to provide new floor levels at elevations 755'-4" and 764'-2", concrete block walls will be constructed between the high bay area and each of the newly installed floor sections on the north side of the building. Two of the 3 floors will have windows installed between the newly occupied space and the existing high bay. These windows will allow in daylight from the existing high bay skylights to enter the new areas, thereby enhancing the quality of the spaces, and allowing occupants to view the activities below.

Concrete block walls and hollow metal doors will be installed to enclose the equipment room, the elevator shaft, the stairway, the toilet rooms and janitor closets, as well as the mechanical and equipment rooms at elevations 731'-4" and 715'-0". An elevator will be installed in the existing previously planned shaft space. The elevator will be a 5,000-pound capacity "hospital" type elevator with openings on either end as required to accommodate the floor plan, with a total of 5 stops. Slight modifications will be made to the roof above the elevator shaft, raising it to a height that will provide the required head clearance for the elevator access to the third floor. An enclosed stair will be construction on the north side of the building, to provide the code required second means of egress for the first, second and third floors. It will consist of steel framing with siding and roofing to match the existing building. The current stairways provide the required exits from below grade spaces.

The entrance level (first floor) of the building (elev 746'-6") will have a raised computer floor system installed over the already constructed depressed floor. Also constructed on this floor will be the interior stairs, the stair enclosure and the wall for the electrical equipment room and elevator enclosure, as well as the wall separating this floor from the high bay. Similar to the first floor, the second floor of the building (elev 755’-4”) will see the construction of the interior stairs, the stair enclosure walls, and the wall closing off this floor from the high bay. In addition, this floor will house the new single user men’s and women’s toilet rooms, the janitor closet and a small kitchenette to service the building occupants. The third floor (elev 766’-0”) will have a raised computer floor system installed over the newly installed concrete floor construction. Constructed on this floor will be the interior stairs, the stair enclosure wall, the elevator enclosure walls, and the wall separating this floor from the high bay.

Finishes

The wall finishes will consist of painted concrete block for the new block walls. The ceiling finish will consist of the exposed underside of the concrete deck, painted with a textured, acoustical material to improve the acoustical qualities of the room. The interior liner panel of the exterior siding will provide wall finishes along the exterior walls. The second floor will have carpeting. The first and third floor computer rooms will have stringer type computer flooring. The computer floors will be isolated to building ground and have a separate under floor ground grid tied to the primary transformer-grounding loop. The toilet rooms, janitor closet and kitchenette will have ceramic tile floors. All other areas (corridors, stairs, mechanical and equipment rooms) will have sealed exposed concrete floors.

Structural

The new floor levels at elevations 755’-4” and 764’-2” will be eight-inch thick post tensioned, prestressed concrete floor slabs that have been selected to provide a minimum floor thickness. The slab will simple span between steel beams framed into the existing steel columns. Final design will evaluate cost and construction benefits of the precast slab system vs. a cast-in-place post tension flat plate floor system.

Conventional Mechanical (HVAC)

The 3rd floor will be outfitted with 4 (CRAC) Computer Room Air Handlers to handle approximately 342 KW to 350 KW heat load from high density computer racks, or 44 computer racks with heat density of approximately 7.8 to 7.9 KW per rack. Each CRAC will be discharging approximately 52 to 56 F supply air into a common underfloor supply plenum. There will be no spare or backup CRAC unit. Each unit will have leak detection sensor. All unit and leak sensors will tie in to a central monitoring panel. The CRAC humidifier system will be plumbed to domestic water to maintain the 45% +- 5 RH at all times. Each CRAC will have corresponding outdoor air-cooled condenser with R22 refrigerant. The raised floor air distribution system plenum height is tentatively set at 1'-10", and may be optimized during design stage. The layout of the racks will utilize the "hot-aisle cold-aisle" concept commonly used in present day high-density data center. Due to lack of ceiling height, there will be no common return plenum. The rack dimension given is based on Wide Band HDCF Project at 3 ft x 2 ft x 6.5 ft height. The placement of this equipment in relation to the CRAC is very critical in ensuring optimum air distribution therefore the floor layout may be final altered during design stage. The space condition is at 72 F dry bulb and 45%RH, and designed with no occupant heat load during standard operation. The space to be occupied by the underfloor cabling is not yet defined but based on preliminary information it is noted that it will occupy minimal space and is assumed to be no more than 20% of the underfloor space. The air supply floor grille will be selected to have higher throw, more free area and less pressure drop to optimize the air distribution.

The 2nd floor office area will be served by a dedicated air-handling unit (AHU) with chilled water coil and electric heating coil. The unit will be located in the mechanical room. Air from AHU (estimated at 5 ton) will be distributed to this area via an insulated ductwork system to be routed to the office area through the pipe/duct chase. This unit will utilize an economizer cycle to cool the space when outdoor air temperatures are appropriate. Minimum outdoor air for 25 persons will be included in the air handling unit design. The space condition is for a typical office space (75 F & 50%RH for cooling, and 68F for heating).

The 1st floor computer area (~132KW or 38 Ton) will be served by a closed loop 55F "electronic cooling water system" (ECW). Except for the ECW header inside the room and the chilled water service to the heat exchanger, the rest of the ECW system, which includes plate heat exchanger, pumps, strainer, UV system, and controls is currently not part of this WBS 3.0, C-0 Outfitting scope. System piping shall be insulated copper. A supplemental computer air handler with no backup, will serve this floor.

The Collision Hall will be served by a dedicated air-handler (estimated at 20 Ton or 8,000 cfm). This air-handler includes chilled water coil, heating coil, and humidifier system to meet the space requirements. There will be two modes of operation, HVAC-normal mode and ODH-purge mode. The cfm requirement for ODH-purge mode is 5,000 cfm. There will be a combination purge fan / return fan that will handle air from the collision hall. The heater coil will be sized to keep supply air above freezing to preclude bursting of the inside piping during ODH mode condition during winter. Redundant HVAC and fan are NOT required, however fans and heaters, required for ODH purge operation will be connected to the generator. The collision hall requires space temperature of 60F to 80F at 40%RH to 50% relative humidity, except during purge mode. The unit will maintain air dewpoint to 53F, except during purge mode. The Collision Hall space requires a continuous constant make up air for inert gas purges, of no less than 50 cfm. Make up air requirement based on ASHRAE will also be included. This will be served by a dedicated outdoor make up air. The ODH airflow requirement is 5000 cfm.

The Assembly Hall will be served by a dedicated air handler (estimated at 20-Ton/8,000 cfm) with chilled water coil, and heating coil system to meet the space requirements. There will be two modes of operation, HVAC-normal mode and ODH-purge mode. Where applicable, the unit will utilize an economizer cycle to provide free cooling when outdoor air temperature is appropriate. There will be a combination purge fan / return fan that will handle air from the assembly hall. The heater coil will be sized to keep supply air above freezing preclude bursting the inside piping during ODH mode condition during winter. Redundant HVAC and fan, and backup power to this unit are NOT required. The Collision Hall requires space temperature of 60F to 80F at 40%RH to 50% relative humidity, except during purge mode. The Assembly Hall space requires a continuous constant make up air for inert gas purges, of no less than 50 cfm. Make up air requirement based on ASHRAE will also be included. This will be served by a dedicated outdoor make up air unit. The ODH airflow requirement is 5000 cfm.

The electronic bridge area will be served with two DX split AC unit. Estimated load given from racks is 2 KW.

There will be one outdoor air-cooled water chiller (no backup), preliminary estimate at 120 ton each, which will provide 45 F glycol-chilled water to the air handlers, make-up air unit and the heat exchanger.

The air handlers, make up air unit, chiller and pump in the mechanical room will be outfitted and will be integrated with site DDC controls building automation system. The building HVAC system will be provided with basic controls and monitoring using DDC (Direct Digital Control) compatible with site wide BAS. The chiller and chilled water loop will be provided with taps and minimum flow, temperature and flow sensors for monitoring purposes and alarm and for future connection to experiments slow process controls. The chiller and pumps are self-controlled and will be started and switched manually. The chiller will have multiple compressors and built in staging controls. Chilled water pump shall be manually started and switched. The 3rd floor High-density computer rack cooling system will be monitored only using Metasys DDC. The Assembly Hall and Collision Hall air system, and ODH purge system will be provided with basic HVAC control compatible with site wide

BAS. Additional sensors and industrial type controls that may be required specific to the experiments will be design and selected by the experimenter/user and commissioning will be coordinated as required. Other sensors and controls as mandated by ASHRAE 90, where applicable to the building system, will be provided

Electrical Room and elevator shaft will not require any HVAC.

Applicable requirement from ASHRAE 90.1 (such as economizer, C02 sensors, ventilation controls) will be incorporated.

Heating. Air handler will be provided with electric heating coil. The high bay will make use of the existing electric space heater.

Building plumbing.

Condensate drains will be provided for the 1st floor and 3rd floor-cooling unit. The mechanical floor will be rework to include floor drains. Building plumbing will be sized and designed in accordance with Illinois Plumbing Code.

Fire Protection / Fire Detection

The fire protection systems will comply with the criteria set forth in the National Fire Protection Association pamphlets and National Building Code. In particular, the pamphlets referenced are as follows:

NFPA 10 – Standard for Portable Fire Extinguishers
NFPA 13 – Standard for the Installation of Sprinkler Systems
NFPA 15 – Standard for Water Spray Fixed Systems for Fire Protection
NFPA 70 – National Electrical Code
NFPA 72 – National Fire Alarm Code
NFPA 90A - Standard for the Installation of Air-Conditioning & Ventilating
NFPA 2001 - Standard on Clean Agent Fire Extinguishing Systems

Currently the existing C-0 Collision Hall has a complete addressable fire alarm system monitoring the entire facility and can be extended to monitor the new fire alarm points. In addition, an existing FIRUS system is installed which signals any fire alarm to our on-site Communications Center, so that emergency personnel can be dispatched.

A description of the fire protection system is as follows:

Collision Hall
Provide a pre-action fire sprinkler system connected to the existing piping network. This system will be designed to provide a minimum of 0.20 gpm per square foot over the most remote 1,950 square feet of sprinkler operation. The pre-action valve will introduce water into the piping network upon loss of air and smoke from an air sampling smoke detection system.

Assembly Hall
Connect with a new sprinkler riser to the existing overhead wet-type fire sprinkler system. This system is designed to provide a minimum of 0.20 gpm per square foot over the most remote 1,500 square feet of sprinkler operation.

Mechanical Rooms
Provide a new wet-type fire sprinkler system utilizing quick response sprinklers, designed to a minimum of 0.15 gpm per square foot over the most remote 950 square feet of sprinkler operation.

Computer/Mezzanine Levels
Provide a new wet-type fire sprinkler system utilizing quick response sprinklers, designed to a minimum of 0.15 gpm square foot over the most remote 950 square feet of sprinkler operation. In addition, a clean agent fire extinguishing system activated by high velocity smoke detection, will be provided to protect the raised computer floors and monitored by an auxiliary releasing fire alarm control panel.

Gas Shed
Provide (IF NECESSARY) a fixed water spray system protecting the gaseous tanks.

Electrical
The primary power transformers will be fed from a new 13.8kv feeder routed through spare ducts in the Main Ring duct bank to a breaker at the Kautz Road Substation (KRS). Prior to the installation of this new feeder, feeder 45 will be routed through a new switch at B-4 from an open bay at the B-4 Service Building air switch to the primary transformers. Feeder 45 will allow approximately 2 megawatts of available power prior to the installation of the new dedicated feeder for equipment power testing and building house power. The feeder will terminate at an air switch located on the primary transformer pad. The final configuration will remove the tie to feeder 45 and install a tie to feeder 49 for backup power. A Kirk key system will be provided. The final installation at C-0 includes one 1500 KVA transformer dedicated to the detector's magnet and other equipment operated by power supplies, one 1500 KVA transformer to supply quiet power for electronics and

computers, and one 1500KVA transformer to supply house power. Critical safety systems will be on a 250 KVA generator with automatic transfer switch. User power will terminate at disconnect switches or circuited panel boards in computer rooms. Because of the structural systems planned and the existing constraints, all conduits will be surface mounted.

C-0 Service Building Upgrade

The C-0 Service Building Upgrade provides for the architectural and HVAC modifications and electrical power additions to support the Low Beta System at C-0. The existing service building consists of office space, shops and data rooms. The current office/tech space will accommodate new power supplies for the Low Beta System. HVAC modifications include the addition of exhaust fans and exterior wall louvers to cool the power supply room.
A new 1500KVA transformer will be installed outside the C-0 Service Building to support the Low Beta System. The transformer will be connected to the power supplies by underground duct bank through the exterior wall of the service building. The transformer shall be fed from the existing pulse power feeder 23 located in the Main Ring Road duct bank. A new 2000Amp switchboard will be installed. Also fed from feeder 23 are new 500 KVA transformers at Service Buildings B-4 and C-1 that will feed 1200 AMP switchboards. Air switches will be installed to transition from 750 MCM to 350 MCM cable. Other than the power upgrades at B-4 and C-1, no other work in the buildings is anticipated as part of WBS 3.0.

DOE Management

The Department of Energy provides funding for this project through the Fermilab annual budget process. The Manager of the Chicago Field Office (CH) has been delegated the authority and responsibility for field oversight of the project. This includes line management authority, responsibility and accountability for overall project implementation and contract administration. Specific responsibilities of CH include support to the Fermi Area Office in the following areas:

- Quality Assurance
- Implementation of ES&H
- Project Management Systems
- Design Review
- Legal

The Fermi Area Office administers the M&O contract with URA for operations of Fermilab and exercises oversight of Fermilab. The Fermi Area Office Manager, Ms. Jane Monhart, has been delegated responsibility and authority for execution of the project. The specific responsibilities of the Fermi Area Office manager are:

- Supervision of DOE Project Manager and Fermi Area Office staff
- Review of and concurrence with this PEP
- Review and approval of documents as required by federal regulations or departmental orders or notices
- Approval of Fermilab subcontract actions, within the authority delegated to Fermi Area Office
- Financial management functions as delegated by CH

Funds will be made available to DOE for the project on an annual basis following passage of legislation in the U.S. Congress. The Fermi Area Office will make funds available to Fermilab for the project based on the existing directive system.

The Fermi Area Office Manager has delegated authority and responsibility for management and direction of the project to the DOE Project Director. The specific responsibilities of the DOE Project Director include:

Review and approval of this PEP and changes thereto

- Measurement of performance against established goals including technical performance, cost levels, and schedule milestones
- Making any necessary changes or corrective actions within the appropriate thresholds established in this PEP
- Overseeing Fermilab's management of construction activities
- Monitoring project progress via reports prepared by the Project Director

- Controlling the project contingency funds and authorizing its use within the levels established within this PEP
- Coordinating the approval by the Fermi Area Office Manager, the construction project directives and modifications thereto

The DOE has delegated the responsibility for design and construction of this project to Fermilab.

Fermilab Management

The project management team structure shown in Figure 1 identifies the organizational structure that will be responsible for design, procurement and construction of WBS 3.0 for the project.

As with all activities at Fermilab, the Directorate is at the highest level of responsibility.

Fermilab through Particle Physics Division (PPD) has designated Mr. Joel Butler and Mr. Sheldon Stone as Project Director and Deputy Project Director, respectively. The details of the WBS 3.0 C-0 Outfitting Project Management responsibilities have been identified in the Responsibilities Matrix contained in the appendix of this document.

Design, construction management, cost and schedule for the C-0 Outfitting portion of this project are the responsibility of the Facilities Engineering Services Section (FESS). FESS, headed by David Nevin, will manage the engineering and civil construction associated with this project. This effort will be accomplished using the resources of the FESS Engineering Group, led by manager Ed Crumpley. The Engineering Manager shall assure proper attention to the coordination and timely completion of the project.

Tom Lackowski (WBS 3.0 Level 2 manager), of FESS/Engineering, will serve as Project Engineer and Construction Manager for this project. The Project Engineer/Construction Manager will utilize the resources of the Engineering Group as appropriate for design, construction phase support, and construction coordination. Portions of the civil design may be subcontracted to an Architectural/Engineering firm. A summary of the Project Engineer/Construction Manager functions and responsibilities is provided in the attached responsibilities matrix.

Mr. Emil Huedem has been assigned as Task Coordinator for this project. The Task Coordinator will handle coordination of design team efforts. A summary of the Task Coordinator functions and responsibilities is provided in the attached responsibilities matrix.

The Business Services Section (BSS), headed by Dave Carlson, has the responsibility for contract administration, providing budget status and subcontract/requisition information. The details of the Procurement Administrator's responsibilities have been identified in the Responsibilities Matrix contained the appendix of this document.

ES&H Management

The ES&H Section, headed by Bill Griffing, with Mary Logue as Associate Head of the Health & Safety Group, has the responsibility for providing safety coordination support and oversight of safety throughout the project. As with all Fermilab projects, attention to ES&H concerns will be part of project management and safety will be incorporated into all processes. Line management for safety on this project will be the responsibility of the Particle Physics Division (PPD). Although line management will be the responsibility of PPD it is understood that for the work that is within the geographical boundaries of the Accelerator Division (AD) the AD rules and guidelines will be followed. In addition all work notification and excavation permits will obtain the approval of the AD Senior Safety Officer.

The ability to perform the construction work safely will be designed into the project. Construction documents (drawings and specifications) will be reviewed as the documents are developed, by Fermilab engineering, construction, and safety professionals to ensure ES&H concerns are addressed. Project specific safety and health requirements for construction will be outlined in the construction documents.

Job coordination during construction will be accomplished through the Fermilab Construction Coordinator (FCC), a member of FESS/Engineering, who shall be responsible for daily monitoring of all work at the site, including the ES&H program. The Construction Manager shall be the first line of contact with the Construction Subcontractor's organization. The FCC reports to the Construction Manager for this project. The Subcontractors will be pre-qualified for bidding by submitting specific information about their safety and health program with the bids. During construction the Subcontractors will use Project Hazard Analyzes

(PHA) to plan the work and mitigate hazards. The FCC will audit the Subcontractor's compliance with the PHA's and with their overall Safety Plan. The Fermilab ES&H Section will support the FCC with safety personnel during construction.

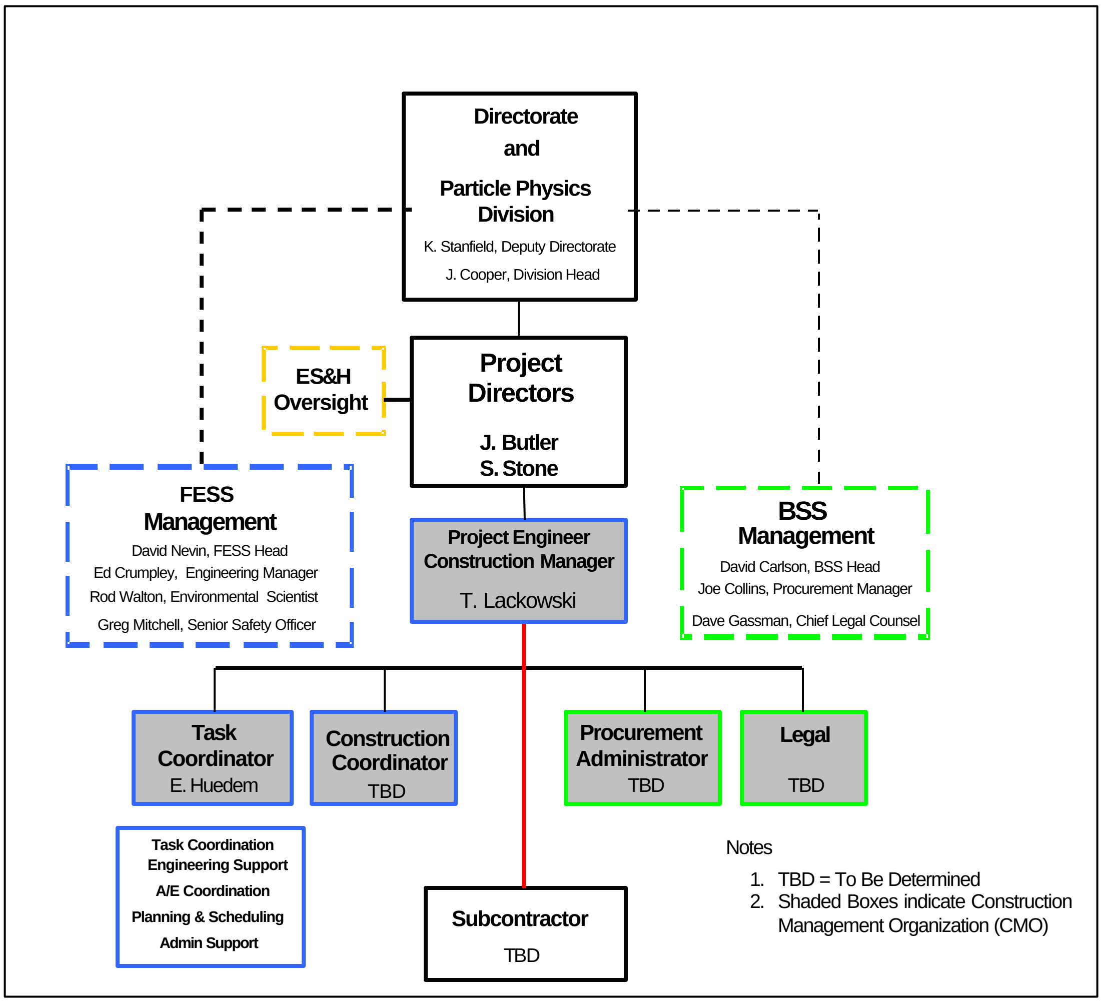

Figure 1 –Organizational Chart

Funding

This portion of the BTeV project has a burdened Estimated Cost (TEC) for WBS 3.0 of $7,213,157 including construction costs, EDIA, contingency, management reserve, and indirect costs. Escalation costs are held and accounted for in the Project Management portion of the project.

Personnel

Divisions and sections will be responsible for assigning the responsibilities of individuals within the design and construction organization as indicated in Figure 1 of Section C. In addition, Fermilab will provide the personnel required to adequately review and oversee design and construction phases.

Design reviews will occur at varying levels throughout Title II. All Divisions and Sections are aware of the design review process and will assign appropriate personnel to complete the reviews for conformance and compliance.

Divisions and Sections will provide required personnel to coordinate construction phase activities that directly affect them. For example, FESS will provide personnel to coordinate related activities with the Construction Manager and Construction Coordinator.

PROJECT BASELINE

The Project Baseline identifies the basis for evaluating project performance. The components are the Work Breakdown Structure, which identifies each component of the project, the Baseline Costs, Escalation Rates, and Baseline Schedule and Milestones.

Work Breakdown Structure (WBS) Dictionary

Listed below is an overview of the WBS dictionary for the C-0 Outfitting project. Further breakdown of the listed structure will be applied as required for accounting and project tracking purposes in the Open Plan schedule.

Engineering, Design and Inspection

ED&I activities include the engineering and design activities in Titles 1 and II, the inspection activities associated with Title III. The descriptions are based on DOE Directive G430.1-1, Chapter 6. In addition, DOE Directive G430.1-1, Chapter 25 was used as guidance in estimating the ED&I costs for this project. The appendix of this document contains these chapters.

Administration

Administration activities include those defined by DOE Directive G430.1-1, Chapter 6 as Project Management (PM) and Construction Management (CM). The appendix of this document contains this chapter of the DOE Directive.

Fixed Price Construction Contracts

Two or more Fixed Price Construction Contracts will be used for the majority of construction work associated with the C-0 Outfitting Project. All lower level tasks will be tracked for progress. Costs and payments will be based on percentage of installed product based on approved cost loaded construction schedule prepared by the Subcontractor.

Direct Procured Purchases

Items have been identified for direct procurement. These Items will be tracked individually.

Time and Materials (T&M)

No T&M work is anticipated at this time. In the event T&M is deemed appropriate it will be costed with the associated Fixed Price Construction Contract project and task.

For accounting purposes, the management reserve of the above listed WBS items will be included in the WBS items, when costed. DOE Directive G430.1-1, Chapter 11 was used as guidance in estimating the appropriate management reserve for this project. The appendix of this document contains this chapter of the DOE Directive.

For accounting purposes, the indirect costs of the above listed WBS items will be included in the WBS items, when costed. For reference purposes Indirect Costs rates are defined by DOE Order 4700.1 that states indirect costs are "...costs incurred by an organization for common or joint objectives and which cannot be identified specifically with a particular activity or project. The multipliers used in this document are based on current Fermilab rates in effect as of October 2002. The appendix of this document contains this current Fermilab Indirect Cost rates.

Baseline Project Costs

The Total Estimated Cost (TEC) for WBS 3.0, C-0 Outfitting, is estimated to be $7,213,157.

No Escalation, Full material Procurement 'Burdening'

Activity ID	Activity Description	Material & Services Cost	Labor Cost	Base Budget	Labor Contingency ($)	Materials & Services Contingency ($)	Total Budget (Base + Contingency)
CONSTRUCTION							
		$4,896,576	$1,084,177	$5,980,754	$216,835	$1,015,567	$7,213,157
1 -- C-0 Outfitting Phase 1							
		$1,812,958	$426,288	$2,239,246	$85,257	$362,591	$2,687,095
2 -- C-0 Outfitting Phase 2							
		$1,859,031	$444,071	$2,303,102	$88,814	$408,058	$2,799,975
3 -- C Sector High Voltage Power Upgrade							
		$599,249	$175,470	$774,720	$35,094	$119,849	$929,664
4 -- Pre Procured Items							
		$625,337	$38,347	$663,684	$7,669	$125,067	$796,421

Escalation

The project baseline has been estimated in first quarter FY 2005 dollars. Escalation will be applied to the baseline costs based on the project's integrated schedule in the Open Plan system and escalation applied in Cobra. DOE Directive G430.1-1, Chapter 10 will be used as guidance in estimating the appropriate escalation for this project. The appendix of this document contains this chapter of the DOE Directive. Escalation will be included in WBS 3.0 Project Management.

Baseline Project Schedule and Milestones

The baseline schedule listed below sets forth the major activities and milestones essential for the completion of the project. The milestones are defined as:

MILESTONE	DEFINITION	BASELINE
MS-0 Start Project	Directive signed	Month 0
3.5.1 Lev1Mil: MS-1 Start Engineering	Engineering work for the project starts when a task is entered into the Task Database	Month 1 01Oct04
3.5.2 Lev2Mil: MS-2 Start Construction	Notice To Proceed Issued	Month 4 28Jan05
3.5.3 Levl3Mil: MS-3 Side Bay. Struct. Complete	Structural steel installed, Concrete floor deck formed, and poured. Formwork removed read finishes.	Month 12 26Oct05
3.5.4 Levl3Mil: MS-4 Temp. Power Operational (Fdr 45)	Substation installed with secondary complete to 2000 Amp switchboards, new air switch installed at B-4, duct bank installed between B-4 and C-0 switch pad. Feeder between B-4 and C-0 Building.	Month 19 17May06
3.5.5 Lev2Mil: MS-5 Ben. Occ. of El: 715 & Receiving	Masonry walls installed and painted. Major mechanical equipment in place. Upper assembly loading dock and crane available to lab for one day per week. Power supply switchboard in place and energized. Subcontractor has limited access to El. 715 slab.	Month 16 17Jan06
3.5.6 Lev2Mil: MS-6 Coll. Hall Complete	Fire detection and electrical panel boards installed and energized.	Month 25 02Nov07
3.5.7 Levl3Mil: MS-7 MECH Systems Complete	All Mechanical equipment installe balanced and tested.	Month 23 19Sep07
3.5.8 Levl3Mil: MS-8 Electrical Systems Complete	All electrical complete and tested.	Month 22 02Aug07
3.5.9 Lev1MIL: MS-9 Construction Complete	Punch list complete. Building commissioning complete. Final acceptance of all work	Month 22 05Oct06
3.5.10 Lev2Mil: MS-10 Engineering Complete	Completion of Close-out Documents	Month 26 08Dec06

Funding Profile

Listed below are the anticipated total costs by fiscal year for this project as contained in the Fermilab Project Request Form.

The project management, construction management, design, construction and inspection for this project is being performed in compliance with the applicable DOE Orders and Laboratory Policy and Procedures and in accordance with the Work Breakdown Structure.

Design

If appropriate, the development of working drawings and bid packages may be accomplished by use of an Architectural-Engineering (A/E) firm in conjunction with the FESS/Engineering Project Team during Title II. The selection of the A/E firm will be based on qualifications and past performance on similar FESS projects. Existing professional services contract will be used to accomplish this work.

The A/E may be retained during Title III for engineering support of the following:

- Bid Period Information Requests;
- Amendment/Addendum Development;
- Shop Drawing/Submittal Review;
- Assistance in estimating and negotiating changes to the subcontracted work;
- Responding to subcontractor request for information including developing sketches/revisions to the subcontract documents
- Periodic site visits;
- Punchlist development.

Construction

The FESS/Engineering group will function as the construction manager for the construction projects, coordinating the subcontractor's construction contract. Field inspection, environment, safety and health, and quality control of construction activity will be the responsibility of the subcontractor. FESS/Engineering will provide quality and safety assurance during construction.

<u>Contract Packages</u>

The majority of the construction work for this project will be accomplished by means of one or more construction packages. The Civil Construction packages will be a competitively bid, lump sum contract. A Time and Materials (T&M) task may be used for preparatory work that is specialized and difficult to include in the competitive procurement process.

<u>Possible Sources for the Civil Construction</u>

Fermilab has access to several Subcontractors that have sufficient qualifications to execute this Subcontract.

Performance Based Incentive Process

The subcontractor will be paid only for work completed. In addition, retention may be reduced from 10% to as little as 2% during the subcontract if the subcontractor maintains a safe environment and meets subcontract milestones.

Methods of Competition

The Request for Proposal (RFP) process will be used to solicit proposals from area Subcontractors with the appropriate safety records and experience to accomplish this work.

Source Selection Process

A Source Evaluation Team (SET) will be established which will include the Project Manager, Construction Manager, and Procurement Officer to evaluate and select a Subcontractor for the Civil Construction Package. Evaluation criteria will be included in the RFP documents as a basis for the SET evaluation of proposals.

Justification for Non-competitive Acquisitions

Anticipated non-competitive acquisitions may include T&M tasks and pre-procured items requiring longer than expected fabrication or delivery time. These items will be identified during the Title 2 phase.

Milestones for Acquisition

Construction milestones will be established for inclusion into the subcontract documents.

Cost Control

A separate cost account will be maintained for the following elements listed in the project WBS: Engineering Design and Inspection (ED&I), Administration, and Construction. The baseline budget for each element will be shown on all reports. Costs accrued by these accounts will be reported monthly on a report issued by the Business Services Section (BSS). The Project Manager will review the report and verify the validity of all cost charges during the reporting period, that commitments are correct and that projections of costs can be covered by the baseline budget for each work element.

The Project Manager has the responsibility for the use and commitment of project funds. Any costs or commitments that are made without his signed approval or that of higher Laboratory management may be rejected. Progress payments to the Architect/Engineer, suppliers, and subcontractors will be made upon receipt and approval of acceptable invoices, nominally on a monthly basis.

The Project Manager, within his authorized limits, will be responsible for the administration of the project's management reserve funds.

The Funding Profile, depicted in Section E, is based on the current DOE funding profile. This plan reflects the best estimate of funding levels and the baseline schedule. The Funding Profile establishes the planned rate of accrued costs for the life of the project. The Project Manager is responsible for updating, as needed, the project Estimate at Completion (EAC) for each work element to reflect changes in design and construction, and for overall project fiscal management.

Schedule Control

The Baseline Schedule, shown in Section E of this report, depicts the milestones and their expected achievement dates. As the project develops, the schedule may be further refined. The Project Manager shall have the responsibility to monitor and control these tasks within the baseline. The baseline may be revised with DOE Fermi Area Office concurrence.

The Project Team will review work progress with the subcontractor at regular intervals. Any identified difficulties will require the subcontractor to provide a plan for their resolution. Significant schedule slippage will be cause for expediting actions by BSS at the request of the Project Manager.

Change Control Procedures and Authorities

Changes to the project baseline can occur to the scope, cost, or schedule aspects of the project. Changes at WBS Level 1 and below will be made with the approval of the Project Manager for cost changes up to $75,000 and schedule changes up to 3 months. Cost and schedule changes above these amounts and changes to the scope of the project as outlined in the CDR will require the approvals of the Change Control Board. Any change to the Total Project Cost will require the approval of the Change Control Board and DOE Fermi Area Office. Project change control will be accomplished in accordance with practices listed below.

Change Control Procedures		
Change	**Approval Required**	**Change Request Form**
Normal Field Changes no added cost or time	Project Engineer and Construction Manager	None
In scope ≤$75k or ≤3 mos. schedule change	Project Manager And Construction Manager	None
In scope >$75k or >3 mos. schedule change	Control Board	Required
Total Project Cost	Control Board DOE Fermilab Directorate	Required
Non-Emergency Required for ES&H regulations	Control Board	Required
Change to Project Scope or Schedule	Control Board DOE Fermilab Director	Required

The Change Control Board (Control Board) will be comprised of the following named individuals or the designees:

DOE Fermi Area Office	P. Philp (non-voting)
Fermilab Directorate	K. Stanfield
Fermilab PPD	J. Cooper
Fermilab FESS	D. Nevin
Fermilab Business Service Section	D. Carlson
Project Manager, Chair	J. Butler

Project Engineer/Construction Manager T. Lackowski

The Project Manager will act as Chair to the Control Board. The Control Board will consider the change requests promptly and, in cases not requiring additional information or discussion, will respond within two weeks.

Integrated Safety Management (ISM)

Fermilab subscribes to the philosophy of Integrated Safety Management (ISM), in accordance with Department of Energy Order 413.3 “Program and Project Management for the Acquisition of Capital Assets.” Fermilab requires its subcontractors and sub-tier subcontractors to do the same. ISM is a system for performing work safely and in an environmentally responsible manner. The term “integrated” is used to indicate that the Environment, Safety & Health (ES&H) management systems are normal and natural elements of doing work. The intent is to integrate the management of ES&H with the management of the other primary elements of construction: quality, cost, and schedule.

The subcontractors shall submit proof of an effective integrated safety management program. The program must be described in the terms listed below.

- Line Management Responsibility for Safety;
- Clear Roles and Responsibilities;
- Competence Commensurate with Responsibility;
- Balanced Priorities;
- Identification of Safety Standards and Requirements;
- Hazard Controls Tailored to Work Being Performed;
- Operations Authorization.

Quality Assurance

All aspects of this project will be periodically reviewed with regard to Quality Assurance issues from Conceptual Design through Title III completion. This review process will be completed in accordance with the applicable portions of the Director’s Policy Manual, Section 10. The following elements will be included in the design and construction effort:

- An identification of staff assigned to this project with clear definition of responsibility levels and limit of authority as well as delineated lines of communication for exchange of information;
- Requirements for control of design criteria and criteria changes and recording of standards and codes used in the development of the criteria;
- Periodic review of design process, drawings and specification to insure compliance with accepted design criteria;
- Identification of underground utilities and facility interface points prior to the commencement of any construction in affected areas;

- Conformance to procedures regarding project updating and compliance with the approved construction schedule;
- Conformance to procedures regarding the review and approval of shop drawings, samples test results and other required submittals;
- Conformance to procedures for site inspection by Fermilab personnel to record construction progress and adherence to the approved contract documents;
- Verification of project completion, satisfactory system start-up and final project acceptance.

Sustainable Building Design

The project processes and each project element are evaluated to reduce their impact on natural resources without sacrificing program objectives. Fermilab designs will incorporate maintainability, aesthetics, environmental justice and program requirements to deliver a well-balanced project. If appropriate, internal and external reviews of design and construction provide a check and balance system for environmental, aesthetic and maintenance issues.

Reliability and Maintainability

Both reliability and future maintenance are considered in the design of all components of Fermilab site. Materials and construction techniques are selected during the design process to provide adequate design life, accessibility, and minimal maintenance.

Value Engineering

It is not anticipated that a separate value engineering exercise will be required for this project. However, internal reviews of designs at various levels of completion will be performed by the most experienced individuals at Fermilab with the goal that more cost effective solutions will be identified.

Risk Management

The majority of the risk management on this project involves the coordinated activities affecting ongoing Fermilab operations. Sufficient schedule float is currently anticipated for the activities related to constructing project to accommodate potential disruptions.

Design Reviews

Internal design reviews are performed at approximately 50% completion and 100% completion. Designs are checked for conformance to project requirements at each review.

This appendix contains:

- Integrated Project Team Responsibility Matrix
- DOE Directive 430.1-1 Chapter 6
- DOE Directive 430.1-1 Chapter 10
- Escalation Rate Assumptions For DOE Projects
- DOE Directive 430.1-1 Chapter 11
- DOE Directive 430.1-1 Chapter 25
- Multi-Organization Construction Site Safety Walkthrough Procedure

INTEGRATED PROJECT TEAM
RESPONSIBILITY MATRIX

Phase of Work	Project Directors	Project Manager	WBS 1.10 Level 2 Manager	WBS 3.0 Level 2 Manager	Directorate	Div/ Sect Head	Procurement	Business Services Legal	Accounting	FESS Management (1)	Project Engineer	FESS Construction Manager	Construction Coordinator	Environment	ES&H Health & Safety	Security
	J. Butler / S. Stone	TBD	J. Howell	T. Lackowski	K. Stanfield	J. Cooper	TBD	TBD	Department	D. Nevin	T. Lackowski	T. Lackowski	TBD	R. Walton	TBD	TBD
Preliminary Design																
set up Engineering task	define project					assess resource availability					define project					
		approve Engineering task			review Engineering task					review Engineering task	submit Engineering task					
		establish T2 performance baseline with PE									establish T2 performance baseline with PM					
						establish budget code				identify available resources	coordinates engineering resources, selection, tasking					
select & task A/E							issue A/E RFP				draft A/E RFP					
				approve selection			establish contract w/ A/E	assist w/ contracting		approve selection	review proposals, select A/E					
		approve tasking					establish task w/ A/E			approve tasking	initiate task requisition					
prepare CDR			coordinate customer team document requirements		provide aesthetic input	provide resources as required				provide resources as required	directs design effort					
			monitor design efforts								interface w/ customer					
CDR approval	approve CDR	approve CDR		approve CDR	approve CDR	approve CDR				approve CDR	submit for approval					
prepare PEP/AP				assist preparation of PEP/AP			assist preparation of PEP/AP	assist preparation of PEP/AP			develop PEP/AP			assist preparation of PEP/AP	assist preparation of PEP/AP	assist preparation of PEP/AP
approve PEP/AP	approve PEP/AP	approve PEP/AP		approve PEP/AP	approve PEP/AP	approve PEP/AP				approve PEP/AP	submit for approval					
prepare NEPA documentation	submit PIF to ES&H									interface with ES&H	draft PIF			review PIF		
														submit recommendation to DOE		
prepare project request form	approve &submit project request	approve &submit project request			create & submit directive request (Budget office)	approve PRF				approve PRF	draft PRF			review submittal		
lab-wide review	review & comment	review & comment	review & comment	approve for release			review & comment	review & comment		review & comment	coordinates CDR review, comment resolution			review & comment	review & comment	review & comment
submit package to Directorate	participate in director review	participate in director review	participate in director review	participate in director review	organize director review	participate in director review	participate in director review			participate in director review	participate in director review					
					aesthetic approval											
					approve project submission											
submit package for Construction Directive Authorization					submit Construction Directive Authorization											
establish funding		request work package			create work package (Budget office)											
cost tracking & control		receive design progress and costs reports		monitor design progress and costs					provide timely cost data to PM	track/invoice FESS Engineering costs	track/project engineering costs					
				approve A/E invoices			approve A/E invoices			approve A/E invoices	review/approve A/E invoices					
project filing				monitor filing						monitor filing	maintain project files					
Final Design																
select & task A/E							issue RFP				draft A/E RFP					
		approve selection		approve selection			establish contract w/ A/E	assist w/ contracting		approve selection	review proposals, select A/E					
		approve tasking		approve tasking			establish task w/ A/E (PO)			approve tasking	initiate task requisition					
direction of A/E		approve change orders		approve change orders		approve change orders	issue change orders			approve change orders	interface w/ customer & Lab organizations					
											lead development of construction documents, drawings, exhibits					
cost tracking & control	monitor design progress & costs	monitor design progress & costs		monitor design progress & costs					provide timely cost data to PM	track/invoice FESS Engineering costs	track/project engineering costs					
				approve A/E invoices			approve A/E invoices		pay invoices	approve A/E invoices	review / approve A/E invoices					
change control for design		requirements change control														
		approve changes to design performance baseline	approve changes to design performance baseline								submit changes to dsign performance baseline to PM					
assign Construction Manager			approve assignment	approve assignment						assign construction manager						
design coordination meetings											coordinate and lead meetings					
source evaluation		participate in SET					participate in SET	provide counsel as requested		participate in SET	participate in SET	chair SET				

(pink)	indicates that action is not to be taken
(yellow)	indicates approval action required

List of Acronyms

A/E	architectural / structural consultant
AP	acquisition plan
BO	beneficial occupancy
CCB	change control board
CDR	conceptual design report
CM	construction manager
D/S	divisions/sections
ICE	independent cost estimate
NTP	notice to proceed
PEP	project execution plan
PIF	project information form (NEPA)
PEP	project engineer
PM	project manager
PO	purchase order
PRF	project request form
QA	quality assurance
RFI	request for information
RFP	request for proposal
SET	source evaluation team

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INTEGRATED PROJECT TEAM
RESPONSIBILITY MATRIX

Phase of Work	Project Directors	Project Manager	WBS 1.10 Level 2 Manager	WBS 3.0 Level 2 Manager	Directorate	Div/ Sect Head		Business Services				FESS			ES&H	
							Procurement	Legal	Accounting	FESS Management (1)	Project Engineer	Construction Manager	Construction Coordinator	Environment	Health & Safety	Security
Exhibit A&B							assist in writing Exhibit A	provide counsel as requested			coordinate writing of Exhibit A&B	assist in writing Exhibit A				
lab-wide design review				approve for release			review & comment	review & comment		review & comment	coordinates review, comment resolution	review & comment		review & comment	review & comment	review & comment
cost tracking & control		monitor design progress		monitor design progress							coordinate engineering resources, selection, tasking, invoices					
	monitor project costs	monitor project costs		monitor project costs												
		approve A/E invoices		approve A/E invoices			approve A/E invoices		pay invoices	approve A/E invoices	review / approve A/E invoices					
												establish CCB for T3				
value engineering (tailored)			participate in value engineering	participate in value engineering						participate in value engineering	coordinate & conduct value engineering	participate in value engineering				
Title II estimate & schedule				review T2 construction estimate & schedule						review T2 construction estimate & schedule	lead development of T2 construction schedule and estimate					
ICE schedule & estimate		review ICE for cost & schedule		review ICE for cost & schedule						review ICE for cost & schedule		develop ICE for cost & schedule				
design sign-off	sign-off	sign-off	sign-off							sign off	sign off	sign off				
develop RFP		review RFP documents		review RFP documents			develop RFP documents				review RFP documents	review RFP documents				
assemble proposal documents							assemble proposal documents				assemble drawings, specs, Exhibit A					
regulatory permits	monitor permitting process	monitor permitting process		monitor permitting process				provide counsel as requested		identify required permits	identify required permits	monitor permitting process		identify required permits		
										provide permit information	provide permit information			prepare permit application		
		approve permit submittal								approve permit submittal				submit application to DOE		
performance baseline for construction		reconcile T2 & ICE schedule & estimate		reconcile T2 & ICE schedule & estimate							reconcile T2 & ICE schedule & estimate	reconcile T2 & ICE schedule & estimate				
		establish T3 performance baseline with CM		establish T3 performance baseline with CM								establish T3 performance baseline with PM				
update PEP/AP				update PEP/AP								assist update PEP/AP				
project reporting	periodic updates to Lab management	periodic updates to Lab management									provide input for periodic updates to Lab management	provide input for periodic updates to Lab management				
	quarterly reports to DOE	quarterly reports to DOE									provide input for quarterly reports to DOE	provide input for quarterly reports to DOE				
directive mods		review & approve requests, submit to DOE		prepare requests for directive mods, submit to D/S	review & approve requests, submit to DOE	review & approve requests, submit to Directorate						assist preparation of directive mods				
project filing				monitor filing			maintain project files			monitor filing	maintain project files					
Procurement CD-3																
issue RFP							issue RFP					initiate construction requisition				
pre-proposal meeting		participate in pre-proposal meeting		participate in pre-proposal meeting			coordinate & chair pre-proposal meeting				participate in pre-proposal meeting	participate in pre-proposal meeting			participate in pre-proposal meeting	
requests for information							issue replys to RFIs				prepare replys to RFIs	review & approve replys to RFIs				
ammendments				review & approve ammendment packages			issue ammendments			review & approve ammendment packages	assemble ammendment packages	review & approve ammendment packages				
proposal evaluations		participate in SET		participate in SET			participate in SET	provide counsel as requested		participate in SET	participate in SET	chair SET			evaluate safety submittals	
							review proposals for business related issues					evaluate corporate quality control plan				
												evaluate schedule submittal				
												forward recommendation to source selection officer				
negotiations	approve negotiation	approve negotiation		approve negotiation			assist in negotiations	provide counsel as requested				conduct negotiations				
subcontract award												initiate requisition for proposal				
		approve award		approve award			award subcontract	provide counsel as requested				approve award		review /accept safety documentation		
update performance baseline for construction		chair CCB								participate in CCB		participate in CCB				
				incorporate approved changes												

INTEGRATED PROJECT TEAM
RESPONSIBILITY MATRIX

Phase of Work	Project Directors	Project Manager	WBS 1.10 Level 2 Manager	WBS 3.0 Level 2 Manager	Directorate	Div/ Sect Head		Business Services				FESS			ES&H	
							Procurement	Legal	Accounting	FESS Management (1)	Project Engineer	Construction Manager	Construction Coordinator	Environment	Health & Safety	Security
project filing				monitor filing			maintain project files			monitor filing	maintain project files	maintain project files				
Construction																
pre-construction meeting				participate in pre-construction meeting			coordinate & chair pre-construction meeting					participate in pre-construction meeting	participate in pre-construction meeting	participate in pre-construction meeting	participate in pre-construction meeting	participate in pre-construction meeting
ES&H Plan												review plan	review plan		review / accept plan	
project quality control plan												review/ authorize plan	review / accept plan			
SESC plan											review plan	review/ authorize plan	review / accept plan			
hazard analysis review / acceptance												review/ authorize plan	review / accept		assist review as requested	
Fermilab permits												monitor process and currency	obtain and maintain currency	oversight of process		
Notice To Proceed							issue NTP					approve NTP	assure precursers are in place			
cost loaded schedule review / acceptance				review & comment								review / accept	review & comment			
submittal list review												review	review / accept			
oversight / direction of A/E		approve change orders		approve change orders			issue change orders			approve change orders	initiate change orders & reqs	approve change orders				
							contract oversight - funding / currency			monitor A/E performance	tasking / direction of A/E effort	monitor A/E performance				
daily inspections / reports										safety support as requested		monitor QA program	daily QA inspections for technical & safety program compliance		safety support as requested	
		monitor progress, trends		monitor progress, trends						monitor progress, trends		issue daily construction report to PM, PE, FESS mgmt	daily construction report to CM			
ES&H inspections / reports	monitor safety program	monitor safety program		monitor safety program								monitor safety program		periodic walkthroughs	periodic walkthroughs	
manhour reports							review DB payroll submittals						obtain manhour reports from subcontractor			
deficiency log												monitor deficiency log	maintain deficiency log			
shop drawing review											coordinate shop drawing reviews	monitor shop drawing status	participate in shop drawing reviews			
											issue actions	approve actions				
											maintain shop drawing log					
engineering change proposals		review / approve		review / approve			issue request to sub			review / approve	initiate request	approve request				
revisions		review / approve		review / approve			issue revision to sub			review / approve	coordinate documents	approve revision				
engineering change requests		review / approve		review / approve			issue change to sub			review / approve	initiate change w/ req	approve change				
claim review / negotiations		assist review / negotiations		assist review / negotiations			assist review / negotiation	provide counsel as requested		assist review	assist review	lead review / negotiation	assist review			
		approve settlements		approve settlements			issue related correspondence									
supplemental agreements							issue supplemental agreements					approve supplemental agreements				
non-compliance memos		monitor non-compliance memos		monitor non-compliance memos			provide counsel as requested	provide counsel as requested			monitor non-compliance memos	issue non-compliance memos	draft non-compliance memos			
weekly construction meeting							attend as requested				attend as requested	chair meetings	attend as requested		attend as requested	
weekly project team meeting		participate in meetings	participate in meetings	participate in meetings			participate in meetings			participate in meetings	participate in meetings	chair meetings	participate in meetings		participate in meetings	
PMG meetings	participate in meetings	participate in meetings		participate in meetings	participate in meetings	participate in meetings	participate in meetings			participate in meetings	participate in meetings	lead presentation	participate in meetings		participate in meetings	
quarterly DOE reports	approve / submit reports											draft reports				
cost tracking & control	monitor construction progress	monitor construction progress		monitor construction progress					provide timely cost data to CM, PM	track/invoice FESS Engineering costs	track/project engineering costs	monitor construction progress	effort & progress reporting			
	monitor project costs	monitor project costs		monitor project costs												
subcontrator progress updates				review & comment on schedule update submittals			review & comment on schedule update submittals			monitor update process		conduct progress updates w/ subcntractor	review & comment on schedule update submittals			
invoice approvals (sub & A/E)				approve invoices			approve invoices			approve invoices	review/approve A/E invoices	review/approve A/E & Subcontractor invoices	assure invoice checklist is complete			
punch list													review & comment on subcontractors punchlist			
				coordinate customer walkthroughs			monitor punchlist activity			monitor punchlist activity	coordinate Engineering portion of walkthroughs		coordinate punchlist walkthroughs			
												transmit punchlist to subcontractor	assemble Lab punchlist			

INTEGRATED PROJECT TEAM
RESPONSIBILITY MATRIX

Phase of Work	Project Directors	Project Manager	WBS 1.10 Level 2 Manager	WBS 3.0 Level 2 Manager	Directorate	Div/ Sect Head		Business Services				FESS			ES&H	
							Procurement	Legal	Accounting	FESS Management (1)	Project Engineer	Construction Manager	Construction Coordinator	Environment	Health & Safety	Security
													monitor completion of punchlist items			
beneficial occupancy				coordinate customer div/sect responsibilities									coordinate walkthroughs			
		approve B.O.					approve B.O.			approve B.O.		transmit B.O. to subcontractor	initiate B.O. Form			
final acceptance		approve final acceptance					approve final acceptance			approve final acceptance		transmit final acceptance to subcontractor	initiate final acceptance form			
update PEP/AP				update PEP/AP								assist update PEP/AP				
incident investigations													initiate call tree			
													obtain report form subcontractor	monitor process	monitor process	monitor process
	monitor response to incident	monitor response to incident		monitor response to incident						assist as required		issue incident report	prepare report for CM	assist as requested	assist as requested	assist as requested
lessons learned										develop lessons learned			assist as requested			
ES&H compliance	monitor safety compliance	monitor safety compliance		monitor safety compliance			monitor safety compliance			assist on technical issues		interface w/ subcontractor on issues	attend safety meetings		assist on technical issues as requested	
										monitor safety compliance		monitor safety compliance	assure subcontractor compliance		monitor safety compliance for PM	
environmental compliance	monitor environmental compliance	monitor environmental compliance		monitor environmental compliance			monitor environmental compliance			assist on technical issues		interface w/ subcontractor on issues	assure subcontractor compliance	assist on technical issues as requested		
										monitor environmental compliance		monitor environmental compliance		monitor environmental compliance for PM		
as-builts													assure as-builts kept current / accurate			
change control for construction				requirements change control												
		approve changes to constructon baseline										submit changes to construction baseline				
directive mods		prepare requests for directive mods, submit to D/S			review & approve requests, submit to DOE	review & approve requests, submit to Directorate										
project filing				monitor filing			maintain project files			monitor filing	maintain project files	maintain project files				
Close-out CD-4																
subcontractor performance reviews													submit personal review to FESS mgmt.			
		participate in review		participate in review			coordinate & lead review			participate in review		participate in review	participate in review		participate in review	
final payment/release retention				approve invoices			approve invoices			approve invoices		review/approve Subcontractor invoices	assure invoice checklist is complete			
							move open items to warrantee						move open items to warranty			
level1 budget close				assure all commitments in place								assure all commitments in place				
				request budget close	activate level 1 budget close	approve budget close										
notice of project closeout		submit request				approve closeout										
final budget close					activate final budget close											
final directive		prepare request for directive mods, submit to D/S			review & approve request, submit to DOE	review & approve request, submit to Directorate						assist preparation of directive mods				
project filing				monitor filing			maintain project files			monitor filing	maintain project files	maintain project files				

CHAPTER 6

PROJECT FUNCTIONS AND ACTIVITIES DEFINITIONS FOR TOTAL PROJECT COST

1. INTRODUCTION

Because of an obvious disparity of opinions and practices with regard to what exactly is included in total estimated cost (TEC) and total project cost (TPC), guidelines were developed and are included in this chapter. The development of guidelines is important because it provides consistency in estimating and reporting of project costs and it provides uniformity of information used for cost data bases. It should be noted that TEC does not apply to most of the EM projects; only TPC applies.

2. DEFINITIONS

Total project cost is defined as all costs specific to a project incurred through startup of a facility, but prior to the operation of the facility. Thus, TPC includes TEC and other project costs (OPC), or

$$TEC + OPC = TPC.$$

A. Total Estimated Cost

TEC is defined as all engineering design costs (after conceptual design), facility construction costs, and other costs specifically related to those construction efforts. These are typically capitalized. TEC will include, but not be limited to: project and construction management during Titles I, II, and III; design and construction management and reporting during design construction; contingency and economic escalation for TEC-applied elements; ED&I during Titles I, II, and III; contractor support directly related to design and construction; and equipment and refurbishing equipment.

B. Other Project Costs

OPCs are defined as all other costs related to a project that are not included in the TEC, such as supporting research and development, pre-authorization costs prior to start of Title I design, plant support costs during construction, activation, and startup. OPCs will include, but not be limited to: research and development; NEPA documentation; project data sheets (PDSs); CDR; short form project data sheets; surveying for siting; conceptual design plan; and evaluation of RCRA/EPA/State permit requirements.

C. Total Project Cost

TPC is defined as all costs specific to a project incurred through the startup of a facility but prior to the operation of a facility. It is comprised of TEC and OPC. TPC will include, but not be limited to, activities such as: design and construction; contingency; economic escalation; Pre-Title I activities; feasibility study reports (FSRs); maintenance procedures (to support facility startup); one-time start-up costs, initial operator training, and commissioning costs; and operating procedures (to support facility start-up).

3. DISCUSSION OF CHARTS

Table 6-1 is a matrix that summarizes the different individual project activities and indicates their designation with respect to TPC and TEC. The project activities identified are divided into different phases of project development. The activities are charged to the different functions that comprise TEC and OPC and are shown in the sequence they would most likely occur.

A. Different Phases of Project Development

The different individual project activities identified are divided into different stages of project development. The first section of the matrix identifies activities encountered during pre-authorization or Pre-Title I design. The second section of the matrix identifies activities encountered during Titles I and II of design. The matrix progresses in that manner to include Title III design and start-up.

B. Different Functions of Total Estimated Cost and Other Project Cost

The different project activities are allocated to different project functions with respect to TEC and OPC. The activities are designated as based on the project phase under which the activity occurs.

1. Total Estimated Cost

TEC is divided into costs associated with ED&I, project management (PM), construction management (CM), and construction contractors (CC).

a. ED&I: ED&I activities include the engineering and design activities in Titles I & II, the inspection activities associated with Title III, and activities defined in the Brooks Bill (e.g., the 6 percent allowed for design, drawings, and specifications).

b. PM: Project management covers those services provided to the DOE on a specific project, beginning at the start of design and continuing through the completion of construction, for planning, organizing, directing, controlling, and reporting on the status of the project.

c. CM: Construction management covers those services provided by the organization responsible for management of the construction effort during Title I and Title II design, and continuing through the completion of construction. CM services are further defined in DOE Order 4700.1, PROJECT MANAGEMENT SYSTEM.

d. CC: Construction contractors cover salaries, travel, and other expenses of engineers, engineering assistants, and their secretarial support responsible for engineering and design performed by the construction contractor. When work normally performed by an architect/engineer (A/E) is performed by a CC, the associated costs are charged to the applicable ED&I accounts.

2. Other Project Cost

Any activities that are not representative of TEC functions are allocated to OPC. They are typically Pre-Title I activities, startup costs, and some support functions.

4. COST ALLOCATIONS

The definitive document within DOE for allocations of cost is DOE Order 2200.6, FINANCIAL ACCOUNTING, but a general discussion of cost allocations follows.

A. Plant and Capital Equipment (PACE) Fund

The Plant and Capital Equipment (PACE) Fund provides funding for the plant and its basic equipment/furnishings. This fund is for conventional construction projects only.

B. Operating Expense Fund

The Operating Expense Fund provides funding for ongoing activities, such as laundry, cleaning, etc. These items are typically captured in site overhead accounts and then allocated to projects as site overhead. Operating expense funded items more directly related to projects are items such as Pre-Title I and start-up activities, etc.

C. Usage

Once standard definitions are developed and the different project activities are identified, it is then possible to uniformly allocate costs to the different project development activities. Table 6-2 is a matrix that summarizes recommended cost allocations for operating expense and PACE (ED&I and construction). It is important to note that the estimator should refer to these tables throughout the entire life of a project.

TABLE 6-1

TPC AND TEC GUIDANCE AND CLARIFICATION
INCLUSION OF DETAILED ACTIVITIES IN TPC AND/OR TEC

ACTIVITY	TPC				
	OPC	TEC			
		ED&I	PM	CM	CC
1. PRE-KEY DECISION - 0 (Prior to Determination of Mission Need)					
A. Engineering Study	X				
B. Alternatives Assessment/Site Selection Studies	X				
C. Surveying for Siting	X				
D. Capital Review Board	X				
E. Candidate Projects (support sheet and presentation to DOE)	X				
F. Conceptual Design Plan	X				
G. Work Orders - CDR Preparation, etc.	X				
H. Integrated Programmatic/Project Schedule (R&D, Safety, Environmental, Operations, etc.)	X				
I. Requirements for Safety Analysis Determination	X				
J. Functional Design Criteria	X				
K. Evaluation of RCRA/EPA/State Permit Requirements	X				
L. Cultural Resources Review	X				
2. Key Decision - 0 and Key Decision - 1 (Determination of Mission Need and Approval of New Start)					
A. Conceptual Design Report	X				
B. Design Reviews	X				
C. NEPA Documentation	X				
D. Conceptual Project Schedule	X				
E. Plant Forces Work Review	X				
F. Energy Conservation Report	X				

TABLE 6-1

TPC AND TEC GUIDANCE AND CLARIFICATION
INCLUSION OF DETAILED ACTIVITIES IN TPC AND/OR TEC

ACTIVITY	TPC				
	OPC	TEC			
		ED&I	PM	CM	CC
G. Economic/Life Cycle Cost Analysis	X				
H. Alternative Engineering (before Title I)	X				
I. Physically Handicapped Review	X				
J. Energy System Acquisition Advisory Board and Acquisition Executive Review Board Support	X				
K. Preliminary Safety Analysis Report (PSAR)	X				
L. Facility/Project Security Review and Plan	X				
M. Facility Security Vulnerability Assessments	X				
N. Master Safeguards & Secure Analysis	X				
O. Construction Project Data Sheet (CPDS)	X				
P. ES&H Requirements Assessment	X				
Q. Strategic Facility Assessment	X				
R. Budget/Conceptual Estimates, as required (Parametric Assessments)	X				
S. Project/Validations Support	X				
T. Monthly Conceptual Status Report	X				
U. Architect/Engineer (A/E) Selection and Statement of Work Development	X				
V. Identification of Project Record Requirements	X				
W. Project Management Plan (PMP)	X				
X. Project Quality Assurance (QA) Plan	X				
Y. Configuration Management Plan (CMP)	X				

TABLE 6-1

TPC AND TEC GUIDANCE AND CLARIFICATION
INCLUSION OF DETAILED ACTIVITIES IN TPC AND/OR TEC

ACTIVITY	TPC				
	OPC	TEC			
		ED&I	PM	CM	CC
Z. Pilot Plants	X				
AA. Research and Development (Project Specific)	X				
AB. Facility As-Built/Existing Condition Drawings (Prior to Design Start)	X				
AC. Obtain Permits Required Prior to Start of Construction (before Title I)	X				
3. Key Decision - 1 and Key Decision - 2 (Approval of New Start and Start of Detailed Design: Title I and II Activities)					
A. PMP Revisions			X		
B. CPDS Revisions			X		
C. Integrated Detailed Project Schedules/Critical Path Analysis			X		
D. Project Revalidations			X		
E. Project Authorization Modification Support			X		
F. A/E Internal Design Coordination		X			
G. Identification of Long Lead Procurements		X			
H. Design Studies		X			
I. Design Calculations & Analysis		X			
J. CADD and other Computer Services		X			
K. Cost Estimates			X		
L. Procurement & Construction Specification Development		X			
M. Design Reviews by Project Team		X	X		
N. Design Review Support	X	X			

TABLE 6-1

TPC AND TEC GUIDANCE AND CLARIFICATION
INCLUSION OF DETAILED ACTIVITIES IN TPC AND/OR TEC

ACTIVITY	TPC				
	OPC	TEC			
		ED&I	PM	CM	CC
O. Drawings		X			
P. Project Schedules			X	X	
Q. Acceptance Test Procedures & Plans		X		X	
R. Certified Engineering Reports		X			
S. Research & Development (required to complete project as defined by KD-0)	X				
T. Performance Evaluations of A/E			X		
U. Inspection Planning			X	X	
V. Surveys - Support Design			X		
W. Design Cost & Scheduling Analysis & Control		X			
X. Decision Progress Reporting		X	X	X	
Y. Design QA Plan and Overview		X	X		
Z. Constructibility Reviews			X	X	
AA. Safety Reviews by A/E		X			
AB. Regulatory Overview by A/E		X			
AC. Reproduction - for Design		X			
AD. Travel - Support Design		X			
AE. Obtain Permits Required Prior to Start of Construction (after Title I)	X				
AF. Change Control - for Design		X	X		
AG. Value Engineering (after Title I)			X		

TABLE 6-1

TPC AND TEC GUIDANCE AND CLARIFICATION
INCLUSION OF DETAILED ACTIVITIES IN TPC AND/OR TEC

ACTIVITY	TPC				
	OPC	TEC			
		ED&I	PM	CM	CC
4. Key Decision - 3 Approval to Start Construction or Full Scale Development to Key Decision - 4: Approval to Commence Operations or Pre-Production (Title III Activities)					
A. Bid Package Preparation			X	X	
B. Bid Evaluations, Opening and Award			X	X	
C. Construction Coordination and Planning			X	X	
D. Contract Administration			X	X	
E. Engineering Support (A/E)			X		
F. Design Changes/Control		X	X	X	
G. Non-Conformance Reports (NCRs)			X	X	
H. Control Systems for Construction Activities			X	X	
I. Project Assessment & Reporting		X	X	X	
J. Construction Status Reports and Meetings			X	X	
K. Davis-Bacon Administration			X	X	
L. Vendor Submittals		X	X	X	X
M. Field Support of Construction			X	X	
N. Field or Lab Tests				X	
O. Radiation Control Timekeepers					X
P. Radiation Protection by Contractor			X		
Q. Safety and Safeguard/Security Operations				X	X
R. M&O Contractor/M&O Project Support During Construction	X				
S. Project Estimates (Purpose Dependent)		X	X	X	

TABLE 6-1

TPC AND TEC GUIDANCE AND CLARIFICATION
INCLUSION OF DETAILED ACTIVITIES IN TPC AND/OR TEC

ACTIVITY	TPC				
	OPC	TEC			
		ED&I	PM	CM	CC
T. Quality Control (QC) Inspection			X	X	X
U. Inspection and Acceptance		X		X	
V. Negotiations of Fixed Price Contract Changes			X	X	
W. Trips to Vendor/Fabricators		X	X	X	X
X. Procurement Coordination			X	X	X
Y. Equipment/Hardware Cost				X	X
Z. Material Procurement Rate				X	X
AA. Initial Office Furniture and Fixtures					X
AB. Spare Parts Inventory	X				
AC. Installation/Alterations					X
AD. Disposal of Mixed Waste					X
AE. Cost Plus Award Fee/Fixed Price Construction		X			X
AF. Plant Forces Work					X
AG. Initial Spares					X
AH. Safety Plan & Overview				X	X
AI. Decontamination (exceeds normal operating levels)	X				
AJ. Decontamination (as removal cost)					X
AK. Surveying to Support Construction			X	X	X
AL. Interest Penalties		X	X	X	X

TABLE 6-1

TPC AND TEC GUIDANCE AND CLARIFICATION
INCLUSION OF DETAILED ACTIVITIES IN TPC AND/OR TEC

ACTIVITY	TPC				
	OPC	TEC			
		ED&I	PM	CM	CC
5. Key Decision - 4: Planning and Preparation for Acceptance/Operational Startup and Pre-production for Commencement of Operations					
A. Perform Acceptance Testing			X		X
B. Perform Operation Acceptance Testing	X				
C. Final Safety Analysis Report (FSAR)			X		
D. Operational Readiness Review (ORR)	X				
E. Start-up Costs	X				
F. Training of Operators	X				
G. As-Builts		X	X		X
H. Project Closeout			X		
I. A/E & Construction Performance Appraisals			X		
J. User Move-In	X				
K. Develop Operating Procedures, Manuals, and Documentation	X				
L. Operations Planning	X				
M. Safety and System Integration	X				
N. Safety Evaluation Report (SER)	X				
O. Post-Acceptance Testing	X				
P. Start Up Coordination, Materials, and Supplies	X				
Q. Correction of Design/Construction Deficiencies					X
R. Transition Planning			X	X	X

TABLE 6-2

RECOMMENDED GENERAL COST ALLOCATION MATRIX

PROJECT DEVELOPMENT ACTIVITY	PROJECTS [1]		
	OPERATING EXPENSE	P&CE	
		ED&I	CONSTR.
Pre Title I	X		
Title I		X	
Title II		X	
Title III		X	
Construction	X[2]		X
Construction Management			X
Project Management		X[3]	X[3]
Project Support	X		
Startup	X		

[1] Applies to Line Item Projects, Major Projects, and Major Systems Acquisitions.

[2] Capital funding for betterments, conversions, and replacements. Alterations are generally funded by operating expense.

[3] Project management during the design phase of Line Item Projects, Major Projects, or Major Systems Acquisitions authorized for design only is funded by P&CE-ED&I.

Reference: DOE Order 2200.6, FINANCIAL ACCOUNTING.

CHAPTER 10

ESCALATION

1. INTRODUCTION

Escalation is the provision in a cost estimate for increases in the cost of equipment, material, labor, etc., due to continuing price changes over time. Escalation is used to estimate the future cost of a project or to bring historical costs to the present. Most cost estimating is done in “current” dollars and then escalated to the time when the project will be accomplished. This chapter discusses how escalation is calculated and how escalation indices are applied. Additional information can be found in DOE Order 5700.2, COST ESTIMATING, ANALYSIS AND STANDARDIZATION.

2. EXAMPLE OF USE OF ESCALATION

Since the duration of larger projects extends over several years, it is necessary to have a method of forecasting or predicting the funds that must be made available in the future to pay for the work. This is where predictive or forecast escalation indices are used. The current year cost estimate is, if necessary, divided into components grouped to match the available predictive escalation indices. Then each group of components is multiplied by the appropriate predictive escalation index to produce an estimate of the future cost of the project. The future costs of these components are then summed to give the total cost of the project. Escalation accuracy for the total project increases with the number of schedule activities used in summation.

To properly apply escalation indices for a particular project, the following data is required:

- escalation index (including issue date & index) used to prepare the estimate;
- current performance schedule, with start and completion dates of scheduled activities; and
- reference date the estimate was prepared.

Following is an example of a 5-year project that requires escalation calculations to determine the total project costs in the base year's dollars.

TABLE 10-1

EXAMPLE OF 5-YEAR PROJECT
REQUIRING ESCALATION CALCULATIONS
ESTIMATE REFERENCE DATE: JULY 1, 1992

Step 1 Determine midpoint of scheduled activity.

			Duration		
Scheduled Activity	**WBS**	**Start**	**Complete**	**(Months)**	**Midpoint**
1. ED&I Title I	A1A	02/01/94	10/01/94	8	06/01/94
2. ED&I Title II	A1B	11/01/94	04/01/95	6	01/15/95
3. ED&I Title III	A1C	04/01/95	01/01/99	45	02/15/97
4. Equipment Procurement (General Services)	B2A	10/01/94	10/01/97	36	04/01/96
5. Equipment Procurement (Long-Lead, GFE)	B2B	04/01/95	12/01/95	8	08/01/95
6. Facility Construction	B2C	07/01/95	08/01/98	37	01/15/97
7. Demolition Work	D1A	01/01/98	09/01/98	8	05/01/98
8. Project Management	E1A	02/01/94	01/01/99	59	07/15/96

Step 2 Select appropriate escalation rates (assume escalation rates are for 1992 base year).

FY-1992 = 1.0	FY-1995 = 3.5
FY-1993 = 2.4	FY-1996 = 3.7
FY-1994 = 3.1	FY-1997 = 3.8

TABLE 10-1 (continued)

EXAMPLE OF 5-YEAR PROJECT REQUIRING ESCALATION CALCULATIONS ESTIMATE REFERENCE DATE: JULY 1, 1992

Step 3 **Calculate appropriate escalation rates for each scheduled activity using estimate preparation date as starting point and apply escalation rates selected in Step 2 to midpoint dates determined in Step 1.**

For Example: ED&I - Title III (midpoint = 02/15/97)

FY-Period	Years	x Escalation Index	= Escalation Factor
07/01/92 to 01/01/93	6/12	.010	.005
01/01/93 to 01/01/94	1.0	.024	.024
01/01/94 to 01/01/95	1.0	.031	.031
01/01/95 to 01/01/96	1.0	.035	.035
01/01/96 to 01/01/97	1.0	.037	.037
01/01/97 to 02/15/97	1.5/12	.038	.005

Compound Escalation

Factor = 1.005 x 1.024 x 1.031 x 1.035 x 1.037 x 1.005 = 1.144 OR 14.4%

Step 4 **The compound escalation factors derived in Step 3 are then applied to the total costs (direct cost + mark ups) for each scheduled activity. Total project escalation is the summation of escalation for all project activities**

Assume costs for Title III design are $100,000 for the base year. The escalated value would be:

$100,000 x 1.144 = $114,400.

Thus, the cost used for Title III designs in the total project cost is $114,400.

Note: Repetition of calculations is obvious; thus, application to a computerized escalation rate analysis forecast program would prove beneficial. Escalation rates applied to scheduled activities are practically tied to the project WBS. Unless a better determination can be made and supported, the midpoint of cash flow for a particular category is set equal to the midpoint of the scheduled activity for that category.

3. ESCALATION RELATIONSHIPS

To compare the costs of projects with differing durations, inflation/escalation costs must be considered. Escalation in cost estimating has two main uses: to convert historical costs to current costs (historical escalation index) and to escalate current costs into the future (predictive escalation index) for planning and budgeting. Historical costs are frequently used to estimate the cost of future projects. The historical escalation index is used to bring the historical cost to the present and then a predictive escalation index is used to move the cost to the future.

Associated with escalation are concepts of present and future worth. These represent methods of evaluating investment strategies like life cycle cost analyses. For example, a typical life cycle cost evaluation would be determining whether to use a higher R factor building insulation at a higher initial cost compared to higher heating and cooling costs over the life of the building resulting from a lower R factor insulation. Present and future worth are discussed in Chapter 23.

A. Historical Escalation

Historical escalation is generally easily evaluated. For example, the cost of concrete differed in 1981 versus 1992. The ratio of the two costs expressed as a percentage is the escalation and expressed as a decimal number is the index. Generally, escalation indices are grouped. For example, all types of chemical process piping may be grouped together and a historical escalation index determined for the group.

B. Predictive Escalation

Predictive escalation indices are obtained from commercial forecasting services, such as DRI/McGraw Hill, which supplies its most current predictions using an econometric model of the United States economy. They are the ratio of the future value to the current value expressed as a decimal. Predictive escalation indices are typically prepared for various groups and may be different for different groups. For example, the escalation index for concrete may be different than the one for environmental restoration.

C. Escalation Application

Economic escalation shall be applied to all estimates to account for the impact of broad economic forces on prices of labor, material, and equipment in accordance with the following requirements.

- Escalation shall be applied for the period from the date the estimate was prepared to the midpoint of the performance schedule.

- Since economic escalation rates are revised at least annually, all estimates shall include the issue date of the escalation rates used to prepare the estimate.

- Costs used for design concept shall be fully escalated and referenced as required.

4. ESCALATION INDICES

Costs continuously change due to three factors: changing technology, changing availability of materials and labor, and changing value of the monetary unit (i.e., inflation). Cost or escalation indices have been developed to keep up with these changing costs. The use of escalation indices is recommended by DOE to forecast future project costs. The use of an established index is a quick way to calculate these costs. To ensure proper usage of an index, one must understand how it is developed and its basis.

A. Developing Escalation Indices

An escalation index can be developed for a particular group of projects. The projects are divided into their elements, which can be related to current industry indices. The elements are then weighted and a composite index is developed. Complete details on developing escalation indices can be found in the DOE Cost Guide, Volume 5, on How to Construct and Use Economic Escalation Indices.

B. Escalation Indices Published by DOE

DOE has developed construction escalation indices for various types of projects. These are published every February and August. A copy of the latest indices can be requested from Office of Infrastructure Acquisition (FM-50).

5. USE OF DOE ESCALATION INDICES

A. How to Select an Index

An index for a project or program is selected based on the type of project (i.e., the scope of work). DOE publishes several indices to cover the range of projects for DOE. If a project or program does not appear to fall into any of the categories, adjustments can be made and must be submitted to FM-50 prior to their use.

More specifically, they must be selected based on the type of cost being escalated since escalation indices represent groups of items. For example, a predictive escalation index for chemical process piping would be inappropriate for use with a cost estimate for a building construction project.

B. How to Apply an Index

The indices are developed with a base year whose index number is 1.0. Generally, the base year is the current year. Once the index is selected, it can be used to either project a current cost based on historical costs, or it can be used to project future costs based on today's dollars.

C. Limitations

Cost indices have limitations since they are based on average data. Thus, judgement is required to decide if an index applies to a specific cost being updated. If using an index for a long-term project, it must be remembered that the long-term accuracy for indices are limited. However, their usefulness to DOE is that the different groups within DOE can use a common index to produce comparable costs.

Escalation Rate Assumptions
For DOE Projects
(January 2003)

	Project Categories *									
FY	**Construction**		**EM**		**IT**		**O&M**		**R&D**	
2002	1.000	N/A	1.000	N/A	1.000	N/A	1.000	N/A	1.000	N/A
2003	1.021	2.1	1.020	2.0	1.008	0.8	1.018	1.8	1.023	2.3
2004	1.046	2.5	1.047	2.7	1.017	0.9	1.045	2.6	1.051	2.8
2005	1.076	2.9	1.075	2.7	1.022	0.5	1.073	2.7	1.080	2.7
2006	1.106	2.8	1.103	2.6	1.032	1.0	1.101	2.6	1.108	2.6
2007	1.135	2.6	1.130	2.4	1.041	0.8	1.127	2.4	1.136	2.5
2008	1.164	2.6	1.157	2.4	1.049	0.8	1.154	2.4	1.164	2.5

These Rates are based on Material and Labor data contained in the Energy Supply Model, provided by DRI-WEFA (now Global Insight), in January 2002. Locally obtained rates, different from those above, may be used. Additional advice and assistance can be obtained from OECM. Points of Contact: T. Ross Hallman, National Energy Technology Laboratory (NETL), 304-285-4837 or Terry Brennan, NETL, 412-386-5989.

* Note that Project Categories are aligned with those Project Categories in the Project Assessment and Reporting System (PARS), which are included as follows:

Construction: (formerly Defense Programs and General Construction Category)

Vertical: Examples: General Building Construction, Administration Buildings, Lab Facilities.

Horizontal: Railroads, Road Work, Bridges, Tunneling, Site Improvements, Site Utilities, Dams / Waterways

Facilities / Infrastructure: Chemical Plants, Vitrification Plants, Process Plants, Incinerators, Accelerators, One-of-a-Kind Facilities, and Modifications.

Environmental Management: (formerly Environmental Management category)

Restoration: Groundwater Remediation, Soils Remediation

D&D/d&d: Reactors, Process Facilities, Administration Facilities, Medical Facilities, Laboratory Facilities, Security Facilities

Information Technology: (***NOT*** formerly a Category or Project Type)

Information Technology and Systems: Hardware, Software, Modeling / Simulation

CHAPTER 11

CONTINGENCY

1. INTRODUCTION

The application of contingency for various types of cost estimates covers the entire life cycle of a project from feasibility studies through execution to closeout. The purpose of the contingency guidelines presented in this chapter is to provide for a standard approach to determining project contingency and improve the understanding of contingency in the project management process. These guidelines have been adopted by the DOE estimating community and should be incorporated into the operating procedures of DOE and operating contractor project team members.

2. CONTINGENCY DEFINITIONS

A. General Contingency

Contingency is an integral part of the total estimated costs of a project. It has been defined as—

> [a] specific provision for unforeseeable elements of cost within the defined project scope. [Contingency is] particularly important where previous experience relating estimates and actual costs has shown that unforeseeable events which will increase costs are likely to occur.

This definition has been adopted by the American Association of Cost Engineers. DOE has elected to narrow the scope of this definition and defines contingency as follows.

> Covers costs that may result from incomplete design, unforeseen and unpredictable conditions, or uncertainties within the defined project scope. The amount of the contingency will depend on the status of design, procurement, and construction; and the complexity and uncertainties of the component parts of the project. Contingency is not to be used to avoid making an accurate assessment of expected cost.

It is not DOE practice to set aside contingency for major schedule changes or unknown design factors, unanticipated regulatory standards or changes, incomplete or additions to project scope definition, force majeure situations, or congressional budget cuts. Project and operations estimates will always contain contingency. Estimators should be aware that contingency is an integral part of the estimate.

B. Buried Contingencies

Some estimators have sought to hide contingency estimates in order to protect the project so that the final project does not go over budget because the contingency has been removed by outside sources. This is affectionately known as buried contingency. All internal and external estimators should refrain from burying extra contingency allowances within the estimate. A culture of honesty should be promoted so that it is not necessary to bury contingency. In addition, estimators should be aware that estimate reviews will identify buried contingency. The estimate reviewer is obligated to remove buried contingency.

3. SPECIFICATIONS FOR CONTINGENCY ANALYSIS

Considerable latitude has been reserved for estimators and managers in the following contingency analysis specifications. These guidelines are to be followed by both the operating contractor and the DOE field office cost estimators to ensure a consistent and standard approach by the project team. Each contractor and field office should incorporate these guidelines into their operating procedures.

A written contingency analysis and estimate will be performed on all cost estimates and maintained in the estimate documentation file. This analysis is mandatory.

Estimators may use the ranges provided in this chapter of the cost guide for estimating small projects; however, larger projects require a more detailed analysis, including a cost estimate basis and a written description for each contingency allowance assigned to the various parts of the estimate.

Justification must be documented in writing when guide ranges for contingency are not followed. If extraordinary conditions exist that call for higher contingencies, the rationale and basis will be documented in the estimate. Computer programs, such as Independent Cost Estimating Contingency Analyzer (ICECAN), a Monte Carlo analysis program, are available to estimators and should be used to develop contingency factors. Risk analysis may also be necessary.

A. Construction Projects

Table 11-1 presents the contingency allowances by type of construction estimate for the seven standard DOE estimate types, and Table 11-2 presents the guidelines for the major components of a construction project.

Estimate types “a” through “e” in Table 11-1 are primarily an indication of the degree of completeness of the design. Type “f,” current working estimates, found in Table 11-2, depends upon the completeness of design, procurement, and construction. Contingency is calculated on the basis of remaining costs not incurred. Type “g,” the Independent Estimate, may occur at any time, and the corresponding contingency would be used (i.e., “a,” “b,” etc.).

Table 11-1. Contingency Allowance Guide By Type of Estimate

Type of Estimate	Overall Contingency Allowances % of Remaining Costs Not Incurred
PLANNING (Prior to CDR) Standard Experimental/Special Conditions	20% to 30% Up to 50%
BUDGET (Based upon CDR) Standard Experimental/Special Conditions	15% to 25% Up to 40%
TITLE I	10% to 20%
TITLE II DESIGN	5% to 15%
GOVERNMENT (BID CHECK)	5% to 15% adjusted to suit market conditions
CURRENT WORKING ESTIMATES	See Table 11-2
INDEPENDENT ESTIMATE	To suit status of project and estimator's judgment

The following factors need to be considered to select the contingency for specific items in the estimate while staying within the guideline ranges for each type of estimate.

1. Project Complexity

Unforeseen, uncertain, and unpredictable conditions will exist. Therefore, using the DOE cost code of accounts for construction, the following percents are provided for planning and budget estimates. They are listed in order of increasing complexity:

- Land and Land Rights 5% to 10%
- Improvements to Land/Standard Equipment 10% to 15%

• New Buildings and Additions, Utilities, Other Structures	15% to 20%
• Engineering	15% to 25%
• Building Modifications	15% to 25%
• Special Facilities (Standard)	20% to 30%
• Experimental/Special Conditions	Up to 50%

Considerations that affect the selection in the ranges are: state-of-the-art design, required reliability, equipment complexity, construction restraints due to continuity of operation, security, contamination, environmental (weather, terrain, location), scheduling, and other items unique to the project, such as nuclear and waste management permits and reviews.

2. Design Completeness or Status

Regardless of the complexity factors listed above, the degree of detailed design to support the estimate is the more important factor. This factor is the major reason that the ranges in Table 11-1 vary from the high of 20 to 30 percent in the planning estimate to 5 to 15 percent at the completion of Title II design. Again, parts of the estimate may have different degrees of design completion, and the appropriate contingency percent must be used. As can be seen from Figure 11-1, as a project progresses, the contingency range and amount of contingency decreases.

3. Market Conditions

Market condition considerations are an addition or a subtraction from the project cost that can be accounted for in contingency. Obviously, the certainty of the estimate prices will have a major impact. The closer to a firm quoted price for equipment or a position of construction work, the less the contingency can be until reaching 1 to 5 percent for the current working type estimate for fixed-price procurement contracts, 3 to 8 percent for fixed-price construction contracts, and 15 to 17.5 percent contingency for cost-plus contracts that have been awarded.

4. Special Conditions

When the technology has not been selected for a project, an optimistic-pessimistic analysis can be completed. For each competing technology, an estimate is made. The difference in these estimates of the optimistic and pessimistic alternative can be used as the contingency.

Table 11-2. Contingency Allowances for Current Working Estimates

	Item Contingency On Remaining Cost Not Incurred
a. ENGINEERING	
Before Detailed Estimates:	15% to 25%
After Detailed Estimates:	10%
b. EQUIPMENT PROCUREMENT	
Before Bid:	
Budget	15% to 25%
Title I	10% to 20%
Title II	5% to 15%
After Award:	
Cost Plus Award Fee (CPAF) Contract	15%
Fixed-Price Contract	1% to 5%
After Delivery to Site (if no rework)	0%
c. CONSTRUCTION	
Prior to Award:	
Budget	15% to 25%
Title I	10% to 20%
Title II	5% to 15%
After Award:	
CPAF Contract	15% to 17-1/2%
Fixed-Price Contract	3% to 8%
d. TOTAL CONTINGENCY (CALCULATED)	Total of above item contingencies

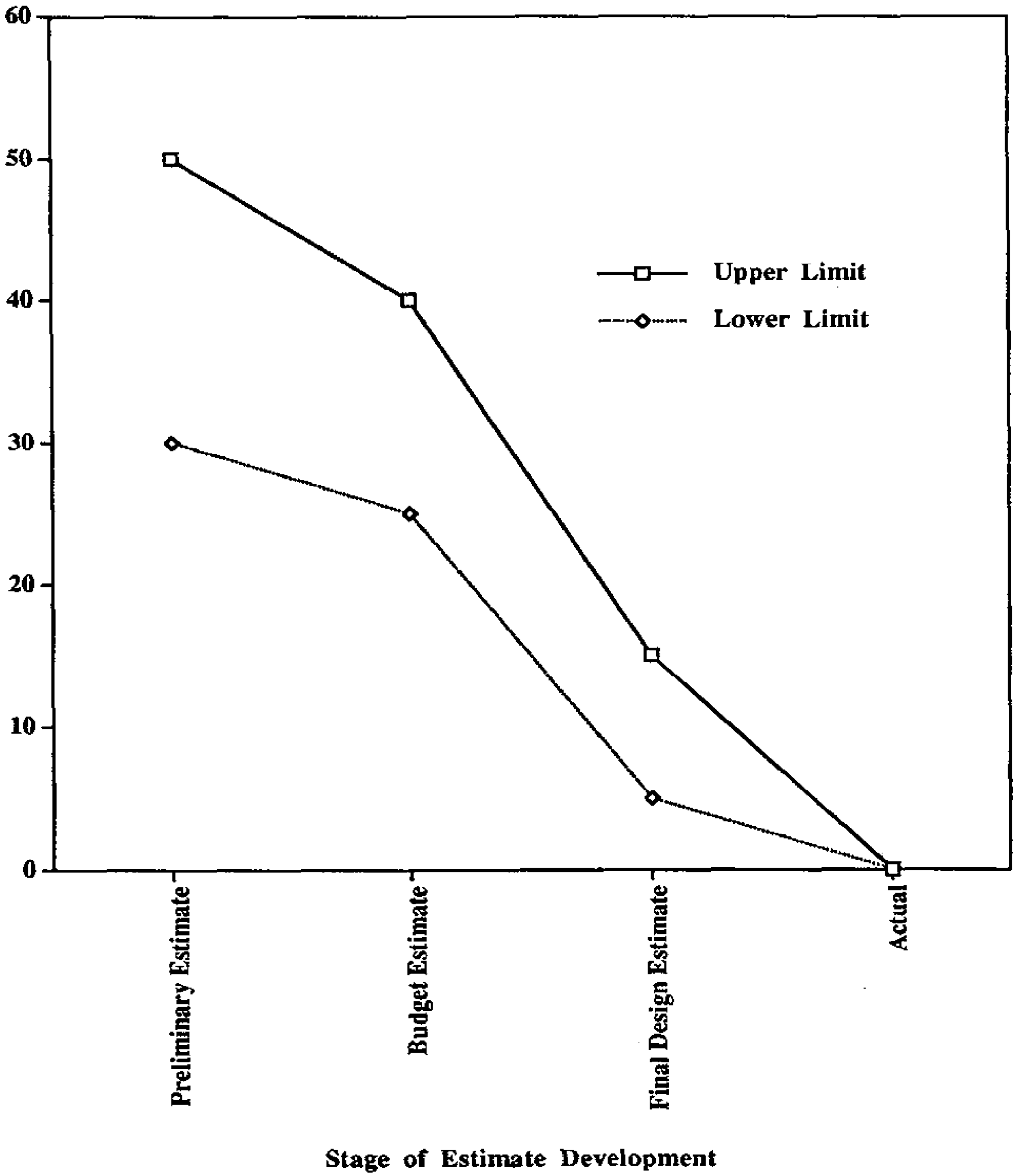


Figure 11-1. Contingency As a Function of Project Life

B. Environmental Restoration Projects

Environmental restoration projects usually consist of an assessment phase and a remediation/cleanup phase. Contingency plays a major role in the cost estimates for both phases. Recommended contingency guidelines for each phase will be discussed below. Table 11-3 lists contingency guidelines for assessment and remediation/cleanup project phases.

1. Assessment Phase

Unlike the remediation phase, the assessment phase does not include the physical construction of a remedy. An assessment determines and evaluates the threat presented by the release and evaluates proposed remedies. As a result, the assessment encompasses such items as field investigations, data analysis, screening and evaluation studies, and the production of reports.

The degree of project definition will depend on how well the scope of the assessment is defined. Higher levels of project definition will correspond to increasing levels of work completed on the assessment. Since the assessment is one of the initial stages of the environmental restoration process, there is a high degree of uncertainty regarding the technical characteristics, legal circumstances, and level of community concern. As a result, the scope of the assessment often evolves into additional operable units, and more than one assessment may be required.

Other considerations that affect the section of contingency ranges are—

- number of alternatives screened and evaluated;
- level and extent of sampling analysis and data evaluation;
- technical and physical characteristics of a site; and
- level of planning required.

Table 11-3 shows the estimate types for the assessment phase of an environmental restoration project and their corresponding expected contingency ranges. No contingency ranges for planning estimates have been provided. The contingencies become smaller as the project progresses and becomes better defined. However, it should be noted that these are only general guidelines based on the level of project definition. A higher or lower contingency may be appropriate depending on the level of project complexity, technical innovation, market innovation, and public acceptance.

Table 11-3. Contingency Guidelines for Environmental Restoration Projects

Activity and Estimate Type	Expected Contingency Range
Preliminary Assessment/Site Investigation Planning Estimate for All Assessment Activities	Up to 100%
Preliminary Estimate for All Assessment Activities	30% to 70%
Remedial Investigation/Feasibility Study Detailed Estimate for All Assessment Activities	15% to 55%
Planning Estimate for All Cleanup Phase Activities	20 to 100%
Contingency Guidelines for Remediation/Cleanup Phase	
Pre-Design Preliminary Estimate for All Remediation/Cleanup Phase Activities	Up to 50%
Remedial Design and Action Detailed Estimate for All Remediation/Cleanup Phase Activities	0% to 25%

2. Remediation/Cleanup Phase

For the remediation/cleanup phase, contingency factors are applied to the remaining design work. Remaining design work will use the same contingency factor as established in the ROD, permit, or current baseline for the project. This contingency percentage will depend upon the degree of uncertainty associated with the project, particularly the degree of uncertainty in the scheduled completion dates.

Table 11-3 shows the estimate types for the remediation/cleanup phase and their corresponding contingency ranges. While the ranges are relatively broad, they reflect the amount of contingency that would have been needed for a set of completed projects. The wide variance accounts for differences in project definition when the estimate was generated, project complexity, technical innovation, and other factors.

Other considerations that affect the section of contingency ranges are:

- innovative technology;
- required reliability;
- equipment complexity;
- construction restraints due to continuity of operation security and contamination;
- environmental conditions (weather, terrain, location, etc.);
- scheduling; and
- other unique items to the project such as waste management permits and reviews.

Prior to the completion of a remedial/corrective measure design estimate, the contingency applied to remaining cleanup work will be no more than that established in the ROD, permit, or current baseline for that project. The percent contingency will depend upon the complexity of the work and the degree of uncertainties involved.

When the construction work is defined by definitive design but the cleanup contract has not yet been awarded, a 15 to 20 percent contingency will be provided on the estimated cost. Usually, the cost estimate is based on detailed drawings and bills of material. When the cleanup work is to be performed by a Cost Plus Award Fee contractor, and the contractor has prepared a detailed estimate of the cleanup cost, and it has been reviewed and approved, a contingency of 15 to 18 percent is applied to only that portion of the cost and commitments remaining to be accrued. On fixed-price cleanup contracts where no significant change orders, modifications, or potential claims are outstanding, a contingency of 3 to 8 percent of the uncompleted portion of the work is provided depending upon the type of work involved and the general status of the contract.

C. Contingency Tools - Monte Carlo Analyses Methodology

Many tools are available to assist estimators with contingency. There is no required tool or program, but Monte Carlo analyses may be performed for all major system acquisitions. Monte Carlo or risk analysis is used when establishing a baseline or baseline change during budget formulation. The contingency developed from the Monte Carlo analyses should fall within the contingency allowance ranges in Table 11-1.

Monte Carlo analyses and other risk assessment techniques use similar methodology to obtain contingency estimates; however, for illustrative purposes, the ICECAN program developed for DOE will be discussed in this section.

The estimator must subdivide the estimate into separate phases or tasks and assess the accuracy of the cost estimate data in each phase. After the project data have been input and checked, the computer program will calculate various contingencies for the overall project based on the probability project underrun. The random number generator accounts for the known estimate accuracy. Once the program has completed its iterations (usually 1000), it produces an overall contingency for the project with a certain accuracy.

The following information is an example project estimate that was input into the ICECAN program.

Base Cost	$1,000,000	Fixed Price
Land Rights	40% $100,000 to $250,000 40% $250,000 to $500,000 20% $500,000 to $600,000	Step-Rectangular Distribution
Labor	50% Less than $100,000 20% $100,000 to $200,000 30% $200,000 to $220,000	Discrete Distribution
Profit	Mean = $235,000 Standard Deviation = $25,000	Normal Distribution

The distribution of the ranges is based on the estimator's judgment. For example, the base cost is a fixed price of $1,000,000 with no anticipated change orders. For landrights, there is a 40 percent chance the cost will be between $100,000 and $250,000, a 40 percent chance the cost will be between $250,000 and $500,000, and a 20 percent chance it will be between $500,000 and $600,000. A step-rectangular distribution was chosen.

The ICECAN program uses the mean cost calculated by the iterations as the base estimate. With the base estimate, there is a 50 percent probability that the project will be underrun. The results in Figure 11-2 show the contingency that should be used to achieve various probabilities overrun. For example, a contingency of 11.1 percent should be used to achieve an 85 percent probability of project underrun. Therefore, the total cost estimate would be $1,901,842. If the worst case cost of each variable had been used, the total estimate would be $2,080,000 or 21.5 percent contingency.

ICECAN

STIMATE FILE: EXAMPLE Contingency Report

Cost Estimate: ***$1,711,863

Probability of Underrun	Contingency Required	Contingency + Estimate
0.50	***********$0 (0.0%)	***$1,711,863
0.55	*********$228 (0.0%)	***$1,712,091
0.60	******$33,137 (1.9%)	***$1,745,000
0.65	******$76,269 (4.5%)	***$1,788,132
0.70	*****$111,558 (6.5%)	***$1,823,421
0.75	*****$140,282 (8.2%)	***$1,852,145
0.80	*****$163,372 (9.5%)	***$1,875,235
0.85	*****$189,979 (11.1%)	***$1,901,842
0.90	*****$224,928 (13.1%)	***$1,936,791
0.91	*****$235,725 (13.8%)	***$1,947,588
0.92	*****$248,795 (14.5%)	***$1,960,658
0.93	*****$257,706 (15.1%)	***$1,969,569
0.94	*****$266,618 (15.6%)	***$1,978,481
0.95	*****$278,856 (16.3%)	***$1,990,719
0.96	*****$292,907 (17.1%)	***$2,004,770
0.97	*****$308,836 (18.0%)	***$2,020,699
0.98	*****$321,089 (18.8%)	***$2,032,952
0.99	*****$343,554 (20.1%)	***$2,055,417
1.00	*****$366,427 (21.4%)	***$2,078,290

Figure 11-2. Contingency Data Results

Operations and Maintenance: (formerly Operating Expense or Waste Management category)

Laboratory Operation and Maintenance: Equipment Replacement, System Maintenance, HEPA Maintenance, Equipment Maintenance

Production Operation and Maintenance: Chemical Processing, Vitrification Operations, Waste Management, Manufacturing

Other Operation and Maintenance: Maintenance Work, Roof Replacement, Building Systems, Landlord Activities, Hotel Load Maintenance.

Research and Development: (Formerly Energy Research and Nuclear, Fossil, Conservation and Solar Categories)

Research and Development: Fossil Energy, Energy Research, Solar Energy, Alternative Energy Sources

Applied Science: Medical, Basic Science

Nuclear Research: Weapons Production, Security Infrastructure, Weapons Simulation, Nuclear Energy

CHAPTER 25

GUIDELINES FOR ENGINEERING, DESIGN, AND INSPECTION COSTS

1. INTRODUCTION

Engineering, design, and inspection (ED&I) activities begin with the preliminary design (Title I). Pre-Title I activities are not considered part of ED&I activities. ED&I activities include the engineering and design activities in Title I & II and the inspection activities associated with Title III. A more detailed description of the Title I, II, and III activities can be found in Chapter 3 of this volume.

Architectural/Engineering (A/E) activities are part of the ED&I activities. A/E activities are services that are an integral part of the production and delivery of the design plans, specifications, and drawings. Federal statutes limit the A/E costs to a percent of total construction cost, and these statutes have specific definitions of what activities are included in A/E costs. Activities that are not an integral part of the production of the design plans, specifications, or drawings may still be ED&I activities but are not A/E activities.

This chapter defines ED&I and A/E activities and discusses how to estimate and track them.

2. ED&I ACTIVITIES

To estimate ED&I costs, the estimator must understand what activities are included in ED&I.

Following is a list of ED&I activities:

- Preliminary and final design calculations and analyses
- Preliminary and definitive plans and drawings
- Outline specifications
- Construction cost estimates
- Computer-aided Drafting (CAD) and computer services
- A/E internal design coordination
- Design cost and schedule analyses and control
- Design progress reporting

- Regulatory/code overview by A/E
- Procurement and construction specifications
- Surveys (surveying), topographic services, core borings, soil analyses, etc., to support design
- Travel to support design
- Reproduction during design
- Design kickoff meeting
- Constructability reviews
- Safety reviews by A/E
- Value engineering
- Identification of long lead procurements
- Design studies not included in Pre-Title I
- Preliminary safety analysis report if not included in the Conceptual Design Report
- Design change control
- Modification of existing safety analysis report
- Design reviews (not third party)
- Acceptance procedures
- Certified engineering reports
- Bid package preparation
- Bid evaluation/opening/award
- Inspection planning
- Inspection services
- Review shop drawings
- Preparation of as-built drawings

3. WAYS TO ESTIMATE ENGINEERING, DESIGN, AND INSPECTION COSTS

Different methods may be used to estimate ED&I costs. Some common methods are: count drawings and specifications, full time equivalents (FTEs), and percentage.

A. Count Drawings and Specifications Method

When using this method, the estimator calculates the number of drawings and specifications representing a specific project. The more complex a project is, the more drawings and specifications it will require, and, therefore, more ED&I Costs will be associated with it.

B. Full Time Equivalent Method

The FTE method utilizes the number of individuals that are anticipated to perform the ED&I functions of a project. The manhour quantity is calculated and multiplied by the cost per labor hour and the duration of the project to arrive at the cost.

C. Percentage Method

When using this method, the estimator simply calculates a certain percentage of the direct costs and assigns this amount to ED&I. Federal statutes limit the A/E portions of ED&I costs to 6 percent of construction costs. Total ED&I percentages are usually from 15 to 25 percent.

D. Documenting Engineering, Design, and Inspection Costs

DOE Headquarters developed the A/E Cost Standard Form as a tool to be used for estimating and compiling actual costs on all conventional construction projects and the conventional portions of nonconventional projects. The DOE ad hoc working group refined a U. S. Navy form to develop this standard for estimating A/E services. The form, definitions, and instructions for the A/E Cost Standard Form have been published and distributed and are included as Attachment 25-1 to this chapter. The following conditions apply to the use of the cost standard or form.

1. All conventional line-item construction projects will use the standard. General plant projects are excluded.

2. Conventional construction projects include such things as warehouses, laboratories, office buildings, non-process related utilities, sewage and water treatment facilities, parking lots, roof repair, roads, etc. Conventional construction does not mean the projects are necessarily simple, nonsophisticated, or standard, but that simply from a design point of view, prior industry experience exists. Nonconventional projects include projects that are first of a kind and the level of effort is not easily predictable.

3. In calculating the design/construction cost percentage ratio, equipment, equipment installation, and other nonconstruction costs will be excluded from the construction cost estimate. Therefore, construction costs included in the calculation will be limited to those construction items for which the A/E contractor has design responsibility. This method is used for determining <u>contract</u> performance. Additional costs for other design, drawings, and specifications (either in-house or outside source) will be documented and included in the total design/construction cost ratio, thereby measuring <u>project</u> performance.

4. The cost standard will be used in the construction of budget estimates and all subsequent estimates and in the management of the cost baselines.

5. A/E contracts will be structured in accordance with the cost standard to segregate design, drawings, and specification costs from the other A/E costs, so that tracking and analyzing actual costs can be accomplished by categories.

6. Any site overhead allocated to construction projects will be identified and documented separately from all other components of project costs so that DOE cost analyses will be comparable to those of other Federal agencies and commercial organizations.

7. The cost standard should be used on all new projects. Project managers will not be required to restructure already completed projects into the format. However, they are encouraged to restructure cost data on completed projects whose cost components are organized in a manner similar to the cost standard format.

8. The A/E Cost Standard Form was designed to provide a standard format for developing cost estimates, structuring contractor proposals, and tracking the cost performance of A/E contracts and other A/E activities. Federal statutes limit A/E cost to 6 percent of construction costs. The A/E services provided under this statute are design, drawings, and specifications. While it is our intention to minimize all A/E costs, it is our goal to keep these specific costs within the 6 percent limit. By collecting costs in this format, the Department can compare its cost performance to other agencies on a comparable basis. Therefore, field offices should ensure that all cost estimates, actual cost data collected during design and construction, and all A/E contracts are segregated to show both total ED&I costs and the subcomponents of design, drawings, and specifications. Also, each site should maintain adequate documentation on actual design and construction costs to facilitate local analysis on the site's overall performance.

   Field Office managers and individual project managers are responsible for ensuring that cost estimates, contracts, and cost management of A/E services are structured according to the above standard. Subsequent historical cost data will be used for project analysis and to support local cost databases. These data should help assess contractor performance, improve future cost estimates, and generate recommendations for reducing the A/E costs, on a site-wide basis.

   With A/E costs or activities being defined, data can be gathered on a more comparable basis. This will allow for easier evaluation, as well as support for the development of local cost databases for A/E costs.

E. Considerations When Estimating

ED&I costs are directly related to the magnitude and complexity of the project. The following items should be considered.

1. Comprehensiveness of the Functional/Operational Requirements

Project understanding is improved when comprehensive functional/operational (F/O) requirements are provided. For the F/O requirements to be well done, each item must be thought through by those who review the design and will use, operate, and maintain the facility or system.

2. Quality Level

Quality level, as defined below, is significant particularly as it affects the analysis, documentation, and inspection required. Design costs are increased by the additional work that may be required by the following levels.

a. Quality Level I

Applied to nuclear system, structure, subsystem, item, component, or design characteristics that prevent or mitigate the consequences of postulated accidents that could cause undue risks to the health and safety of the public.

b. Quality Level II

Any other system, structure, subsystem, item, or component that as a result of failure could cause degradation of required performance, such as plant operation, test results, and performance data.

c. Quality Level III

Items designated for minimal impact applications.

3. Design Planning Tabulation

Design Planning Tabulation (DPT) sets forth a number of important items that affect ED&I costs. The DPT sets the code requirements the design will meet, reviews to be held, quality levels, and documents to be issued.

4. Design Layout

Design layout costs are affected by the availability of existing documents and the accuracy of these documents. The need for an engineer to make detailed layouts rather than having it done by draftsmen/designers also affects cost.

5. Engineering Calculations

The amount and detail of calculations required is an important engineering cost factor. The need for review of these calculations by others and their documentation and storage can affect ED&I cost significantly.

6. Drafting

The drawing format and the method of accomplishment of the work depicted (i.e., by maintenance, lump sum construction contract, or cost plus construction contract) will affect the detail and time required to prepare drawing(s). The type of drawing and the discipline of work are also big factors in time required. The number of drawings involved is a direct indication of drafting time and cost. The availability of standard details, etc., can reduce costs appreciably. Quality Level I or II requirements can also add to drafting requirements and thus time.

7. Specification Preparation

The availability of draft specifications for the items of work involved or the need to develop new specifications must be considered. Projects requiring preliminary proposals require both an outline specification, which is normally prepared with Title I, and a detailed technical specification. Performance specifications for both the design and installation by a subcontractor of facilities and systems, such as fire protection, will reduce engineering costs. Design costs incurred by the subcontractor are classified as subcontract construction costs.

8. Checking

The need for field investigation can be a significant engineering cost. If drafting must be checked by checkers within that section, the time must be considered and costs added. Projects requiring inter-discipline checks must have time/cost provisions. Checks made by engineers must also be considered.

9. Cost Estimating

Time required for estimating is affected by the detail of the project, particularly the number of items involved and the areas in which good information from historical data or test hooks on cost are available. Specialty items usually require additional effort and cost.

10. Design Reviews

The number of design reviews and action taken will affect costs. If the design is so formal that a committee is established for the review and the designers must present their designs step by step, the additional costs required for review must be included.

11. Safety Analysis Report

When a Safety Analysis Report (SAR) is required, the engineering costs are contingent upon similar documents having been prepared previously or the requirements to develop new ones.

12. Reports

Engineering costs for preparing reports such as preliminary proposals, design status reports, etc., must be included in the ED&I funds.

13. Government Furnished Equipment

Engineering costs for providing documents required for procuring Government Furnished Equipment (GFE) items must be included. These costs include specifications. Time required for engineering is more than if the item had been included with the other technical documents due to document control and the need to include in the technical documents information on the item being furnished.

14. Off-Site A/E

If an off-site A/E is to be used for the design, travel costs for field investigation, design reviews, and management of the design should be considered. Cost is a percentage of construction cost. If changes are required, onsite A/E may have to make the changes, which could lead to problems in interpreting or understanding the basis of the original design.

15. Inspection

Included as part of Title III, all construction work, including procurement and installation of associated equipment, shall be conducted in all cases prior to acceptance. Inspection should be made at such times and places as may be necessary to provide the degree of assurance required to determine that the materials or services comply with contract and specification requirements, including quality level requirements. The type and extent of inspection needed will depend on the nature, value, and functional importance of the project and its component parts, as determined by project requester/proposer. Specifically, the following should be considered.

16. Duration

Duration is the number of actual construction days anticipated for the project. Unforeseen conditions, such as delays in start-up and waiting for materials, are not included in this duration.

17. Labor Density

Labor density is the ratio of estimated costs of materials to costs of labor. In general, construction with a high labor density will require more inspection.

18. Complexity

A project having a high degree of instrumentation of a large amount of "code equivalent" welding will require more inspection per dollar of labor than will earth work or ordinary concrete work.

19. Overtime

The time schedule of utility outages, reactor windows, and the overall project schedule may require overtime.

20. Adequacy of Plans and Specifications

If the technical package is clear, with a minimum of ambiguities, and will require few field changes, the inspection cost will be lower.

21. Offsite Fabrications

Inspection costs will increase if source inspections are required. Supplies and services shall be inspected at the source where:

a. inspection at any other point would require uneconomical disassembly or nondestructive testing;

b. considerable loss would result from the manufacture and shipment of unacceptable supplies or from the delay in making necessary corrections;

c. special instruments, gauges, or facilities required for inspection are available only at source;

d. inspection at any other point would destroy or require the replacement of costly special packing and packaging;

e. a quality control system is required by the contract, or inspection during performance of the contract is essential;

f. it is otherwise determined to be in the best interest of the Government.

22. Location of the Job

Travel time to and from the job must be taken into consideration.

23. Guideline

ED&I costs have been between 15 percent and 26 percent of the total construction cost for detailed design.

24. Performance Specification

This type of specification requires the subcontractor to supply the amount of detail required to complete the project. The amount of ED&I required for a performance specification is appreciably less than that required for the detailed design.

F. Engineering

Although these services may seem similar to conventional engineering, design, and inspection, there are several important differences that distinguish cleanup design from engineering design on other projects. These differences need to be underscored when estimating cost and schedule requirements. Major factors to be considered by the estimator include the following.

1. The regulatory process requires rigorous examination of design alternatives prior to the start of cleanup design. This occurs during remedial investigation/feasibility studies under CERCLA to support a record of decision (ROD) or during corrective measure studies under RCRA to support issuance of a permit. Cleanup design executes a design based on the method identified in the ROD or permit. This often narrows the scope of preliminary design and reduces the cost and schedule requirements. The estimator needs to assess the extent to which design development is required or allowed in cleanup design. In some cases, the ROD or permit will be very specific as in the case of a disposal facility where all features, such as liner systems, as well as configuration, are fixed. In other cases, such as when treatment options like incineration are recommended, considerable design effort may be required.

2. Requirements for engineering during construction including, construction observation, design of temporary facilities, quality control, testing, and documentation, will often be higher than for conventional construction. This results from the need to conduct construction activities for environmental projects in compliance with rigid regulations governing health and safety, quality assurance, and other project requirements.

CHAPTER 25

ATTACHMENT 25-1

A/E COST STANDARD FORM USAGE GUIDANCE

The Architect/Engineer (A/E) Cost Standard Form was designed to provide a standard format for the collection of A/E costs. Federal statutes limit the A/E costs to a percent of total construction cost, and these statutes have specific definitions of what is included in A/E costs. By collecting costs in the format of this form, the Department will be consistent with the definition of A/E costs used by other Federal agencies and will be able to determine what is being spent on A/E costs on a uniform basis throughout the Department.

The form, attached, is divided into three sections:

- Section A - Design
- Section B - Title III Services
- Section C - Engineering Services

Some departments may use different names for some of the functions described in the form. If this is the case, a crosswalk sheet can be developed and used to aid in converting the terms used locally to fit those in this form. If necessary, items can be added to each section. Sheets should be attached to completely define any items added. Minimal additions or changes are anticipated in Sections A and B, while Section C will more commonly have additions.

This form is used to collect Engineering, design, and inspection (ED&I) costs according to DOE Order 2200.6. Pre-Title I activities are not a part of ED&I. Pre-Title I activities include surveys, topographical services, core borings, soil analysis, etc., that are necessary to support design. These activities are charged to operating costs. Other costs that, according to DOE Order 2200.6, are not part of operating costs, include project management, the maintenance and operation of scheduling, estimating, and project control systems during design and construction, and the preparation, revision, and related activity involved in producing the final safety analysis report.

The attached “A/E Cost Standard Form - Engineering and Design Activities” table lists the Title I, Title II, and Title III activities and groups them in Sections A, B, or C as they appear on the A/E Cost Standard Form

A/E COST STANDARD FORM **10/92**
Page 2

The following will discuss each section individually.

Section A - Design

Section A includes the Title I and Title II costs directly related to developing the design drawings and specifications necessary for the project. Note that Section A includes only the cost of labor hours that are necessary to perform this design work. If, because of project requirements, other disciplines are required, they can be added. Note that other Title I and Title II costs can be covered in Section C.

Section B - Title III Services

Section B includes the costs for reviewing shop drawing submittals, inspection services, and the preparation of as-built drawings.

Section C - Engineering Services

Section C includes the support services required during the Title I, Title II, and Title III project work. This includes such activities as the energy conservation study, cost engineering, value engineering services, travel, computer equipment costs, etc. Note that the Computer Aided Drafting (CAD) operator’s time is included in Section A. Note also that some of the activities in Section C, such as travel and per diem, can occur in Title I, Title II, and Title III work.

Design Schedule

The design schedule should be filled out in the bottom left-hand portion of the form under Section C. The cost summary is filled out to the right of the design schedule and includes the costs of Sections A, B, and C, which are added together to generate a total ED&I cost.

A/E COST STANDARD

DOE Architect-Engineer
Cost Standard Form

A/E Firm Name:	Consultant's Name(s):	A/E Contract No:
Project Title:		DE No: / Field Office:
Location:		Est.Const.Cost:

Section		Engineering Discipline	Est. No. Dwgs.	Hourly Rate	Title I Est. Hrs.	Title I Estimated Cost A/E	Title I Estimated Cost Consul-tant	Title II Est. Hrs.	Title II Estimated Cost A/E	Title II Estimated Cost Consul-tant	Total Design Est. Hrs.	Total Design Estima-ted Cost
SECTION A DESIGN	DRAWINGS	Project Engineer										
		Architect										
		Stru Engineer										
		Mech Engineer										
		Elec Engineer										
		Civil Engineer										
		Fire Engineer										
		Coordination QC										
		Arch Draftsman										
		Stru Draftsman										
		Mech Draftsman										
		Elec Draftsman										
		Civil Draftsman										
		Fire Draftsman										
		Total Drawings										
	SPECS	Spec Writer										
		Typist										
		Total Specifications										
	Total Est. Cost A/E & Consultant											
	Overhead A/E _____			Consult. ______%								
				Subtotal								
				Profit _____%								
				Subtotal								
				Total cost of section A (Design)			$ _____ sheet		% of ECC _____ %			

COMPUTE COST PER SHEET AND DESIGN PERCENTAGE OF ESTIMATED CONSTRUCTION COST

ENGINEERING SERVICES SUMMARY SHEET (PROVIDE BACK-UP FOR EACH ITEM)		TITLE I	TITLE II	TITLE III	TOTAL
Section B Title III Services	Review of Shop Drawing Submittals				
	Inspection Services				
	Prepare As-Built Drawings				
	Total Cost of Section B				
SECTION C ENGINEERING SERVICES	Inspection Planning				
	Design QA Plan				
	Reproduction During Design				
	Constructability Reviews				
	Certified Engineering Reports				
	Design Studies Not Included in Pre-Title I				
	Project Schedules				
	Cost Engineering				
	Value Engineering Services				
	Travel to Support Design				
	Other (Specify)				
	Total Cost of Section C				

DESIGN SCHEDULE	30% Submit/Rev = ____ wks	COST SUMMARY	Total Section A (Design)				
	60% Submit/Rev = ____ wks		Total Section B (Title III)				
	90% Submit/Rev = ____ wks		Total Section C (Engr Serv)				
	Final Submit /Rev = ____ wks TOTAL = _____ wks		GRAND TOTAL - Fee Proposal				
SIGNATURE		APPROVAL				DATE	

A/E COST STANDARD FORM
ENGINEERING AND DESIGN ACTIVITIES

	TITLE I ACTIVITIES	TITLE II ACTIVITIES	TITLE III ACTIVITIES
S	Preliminary Design Calculations and Analyses	Final Design Calculations and Analyses	
E	Preliminary Drawings	Definitive Drawings	
C	Preliminary Plans	Definitive Plans	
T	Outline Specifications	Procurement and Construction Specs	
I	CAD and Computer Services (operators)	CAD and Computer Services (operators)	
O	A/E Internal Design Coordination	A/E Internal Design Coordination	
N	Design Cost and Schedule Analysis and Control	Design Cost and Schedule Analysis and Control	
	Design Progress Reporting	Design Progress Reporting	
A	Regulatory/Code Overview by A/E		
S	Design QA Plan and Overview	Travel to Support Design	Inspection Services
E	Travel to Support Design	Reproduction During Design	Review Shop Drawings
C	Reproduction During Design	Designs Reviews, QA, and Overview (not Third Party)	Prepare As-Built Drawings
T	CAD and Computer Services (support)	CAD and computer Services (support)	
I	Project Schedules	Project Schedules	
O	Construction Cost Estimates	Constructability Reviews	
N	Constructability Reviews	Safety Reviews by A/E	
S	Safety Reviews by A/E	Construction Cost Estimates	
	Value Engineering	Acceptance Procedures	
B	Identify Long Lead Procurements	Certified Engineering Reports	
	Design Studies Not Included in Pre-Title I	Bid Package Preparation	
and	Preliminary Safety Analysis Report if Not Included in the CDR		
	Design Change Control	Design Change Control	
C		Inspection Planning	

Note: This representative list of functions was developed from FAR and DOE definitions.
All functions meet FAR criteria, and the categories are segregated according to the FAR.

FY 2003 RATE SHEET

Indirect | Fringe | OPTO | Vacation | Chargeback

INDIRECT RATES

	ACTUAL	EFFECTIVE
MSA	**5.5%**	**16.1%**
CSS	**18.5%**	**30.4%**
G&A	**10.0%**	**10.0%**
PASS THROUGH	**1.5%**	**1.5%**

FRINGE RATES

FRINGE	**30.0%**	**30.0%**
SUMMER STUDENT FRINGE	**8.0%**	**8.0%**

VACATION/OPTO RATES

	WEEKLY	MONTHLY
VACATION ACCRUAL	**11.0%**	**11.0%**

OTHER PAID TIME OFF (OPTO)	**9.0%**	**6.5%**

CHARGEBACK RATES

MACHINE SHOP CHARGE BACK RATE	**$55.00**
FESS ENGINEERING CHARGE BACK RATE	**$71.00**

Fermilab
ESH Section

Multi-Organization Construction Site Safety Walkthrough

1.0 Background and Purpose

Background: The vast majority of incidents happen when barriers are bypassed, procedures are not followed or there are departures by workers from safe behaviors. Unsafe conditions have historically been a small percentage of the causes of accidents whereas behaviors or unsafe acts are the bulk of the causes. In order to eliminate these incidents from the workplace we must concentrate our efforts to those actions that will have the biggest return on “investment” such as the elimination of unsafe behaviors and the evaluation of work processes and barriers to determine conformance with accepted practices.

Purpose: To establish a process for conducting formal safety program evaluations and field assessments through site safety walkthroughs for construction activities. These walk-throughs should consider management systems, employee behaviors, conformance to the subcontractor safety plan, and performance to Fermilab requirements as expressed in contractual documents, pre-bid and pre-construction meetings.

2.0 Scope

This procedure applies to all active construction activities that require a multi-organizational scrutiny as designated by the Associate Director for Operations.

3.0 Responsibilities

3.1 Construction Manager

3.1.1 Determine the frequency of walkthroughs based upon input received from the Associate Director for Operations and the Project Manager. Frequency should be identified in the Project Execution Plan (PEP).

3.1.2 Identify walk-through team members. The team should be kept to a reasonable size and may include the Construction Manager, Construction Coordinator, Subcontractor Superintendent, a representative from the Fermilab ESH Section, a representative from the Department of Energy Fermi Area Office if requested, and a Project ESH Coordinator, if one is assigned.

3.1.3 Conduct a closeout meeting as described below.

3.2 Construction Coordinator

3.2.1 Assist the Construction Manager in the walkthrough process as requested. Such requests may include:

3.2.1.1 Transmit all concerns to the Sub-Contractor for resolution and provide copies to all team members.

3.2.1.2 Review corrective action responses from the Sub-Contractor and provide feedback to the Construction Manager and the Project ES&H Coordinator.

3.2.1.3 Track responses to action items (in a formal database, daily/weekly logs or construction meeting minutes).

3.2.1.4 Document & distribute closeout-meeting minutes.

3.3 ES&H Section Representative

3.3.1 Provide technical support relative to safety issues.

3.4 Project ES&H Coordinator

3.4.1 Participate in walkthroughs keeping an eye especially toward safety issues that would impact installation and operational activities that will follow construction.

3.4.2 Provide feedback from walkthroughs and closeout meetings directly to the Project Manager.

4.0 Procedure

4.1 The Construction Manager (CM) will identify the time and frequency of the walkthrough.

4.2 The CM will develop an agenda for the walk-through and identify any specific areas to focus on. Appendix A should be used as guidance. Trying to cover a broad spectrum of programs or activities may result in specifics being missed. This is especially true for a larger project, or one covering more than one work site. Interviews with subcontractor employees are encouraged.

Field observations from one visit may give rise to focused assessments at a future date or provide justification for a formal audit.

4.3 CM will complete a closeout meeting with all participating organizations to discuss results of the walkthrough and to discuss suggestions for possible corrective actions.

4.4 Document walkthrough results through meeting minutes that will be distributed to all participating organizations.

4.5 Enter concerns and corrective actions into a database created for the specific project.

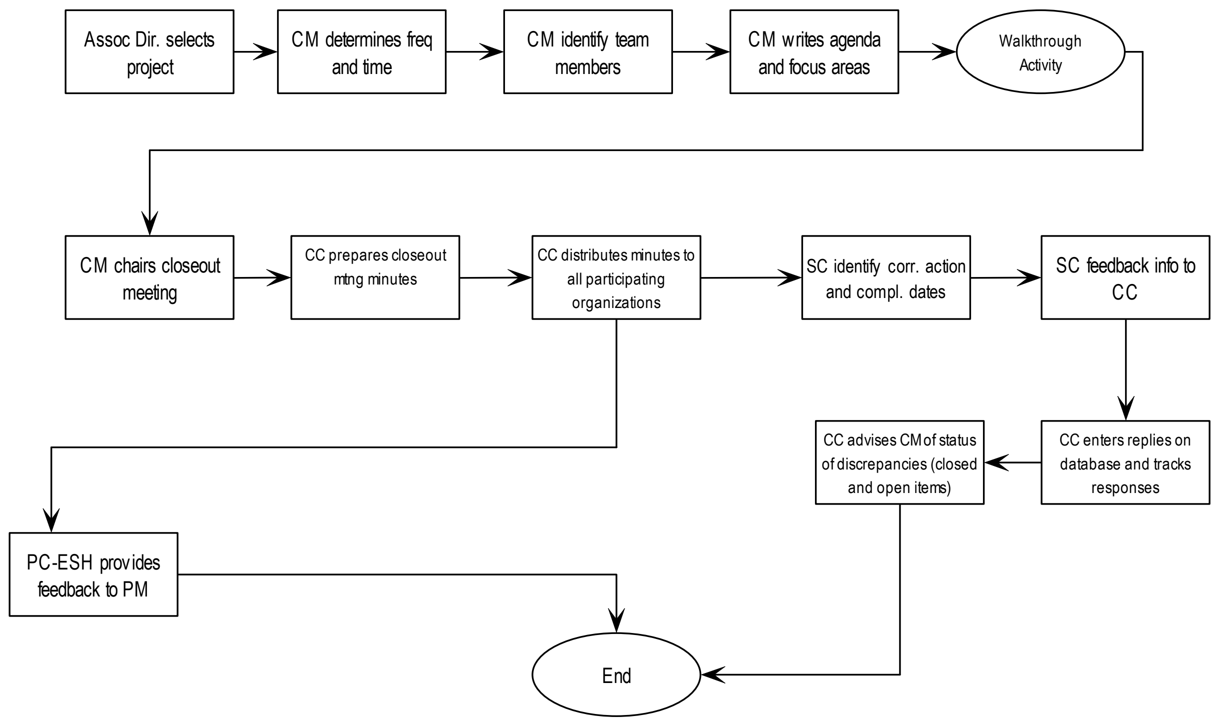
5.0 Corrective Actions

5.1 The walkthrough report shall be provided to the subcontractor for action.

5.2 The subcontractor shall identify corrective actions and completion dates. Corrective actions shall be completed as quickly as possible.

Flow Diagram

Construction Project
Multi-Organizational Safety Walkthrough



Abbreviations:

ADO	Associate Director for Operations
CM	Construction Manager
CC	Construction Coordinator
PC-ESH	Project ES&H Coordinator
PM	Project Manager

Appendix

ESH Assessment Guidance- Areas of Inquiry

1. Injuries or Illnesses

2. General
   - Housekeeping
   - Garbage Containers
   - Emergency Phone #s Posted
   - Emergency Communication
   - Fence Condition
   - Gates
   - Signage on Fences and Gates
   - Whip Checks
   - Electrical Cords
   - GFCI's
   - Gas Test Log
   - Machine/Equipment Guards
   - Lighting
   - Ladders
   - Explosive Storage
   - Oxy/Acetylene Storage
   - Scaffolding

2. Traffic Control
   - Barricades
   - Traffic Signs
   - Flag Person
   - Vests
   - Flag

3. Shafts & Tunnels
   - Hand held lights/Miners Lights
   - Lighting
   - Communication
   - Ventilation
   - Self Rescuers Present

- Housekeeping
- Air/Noise Testing
- Signage
- Barricades

4. Emergency Equipment
   - Fire Extinguishers
   - First Aid Kits
   - Oxygen
   - Blankets
   - Eye Wash
   - Infection Control
   - Medical Emergency Teams
   - Rescue Teams

5. Personal Protective Equipment
   - Hard Hats
   - Eye Protection
   - Hearing Protection
   - Foot Protection
   - Respiratory Protection
   - Hand Protection
   - Fall Protection Harness/Lanyard
   - Face Protection
   - Barrier Cream

6. Cranes
   - Inspections
   - Certifications
   - Anti-Two Blocks
   - Hook Latches
   - Perimeter Barricades
   - Glass
   - Horn
   - Fire Extinguisher
   - Rigging Equipment

7. Equipment
   - Daily Inspections
   - Glass

- Back-Up Alarm
- Fire Extinguishers
- Hydraulic Oil Leaks

8. Work Planning
   - H/A for Tasks Performed
   - Dail Huddles
   - Tool Box Meetings
   - Monthly ESH Meetings
   - Records/Log Reviews
   - LOTO